COLOR · STVDY

CROSS

NATIONAL DRAWING COURSE.

TEXT-BOOKS.

Free-Hand Drawing.
Mechanical Drawing.
Color Study.
Light and Shade. *(In preparation.)*
Historic Ornament and Design. *(In preparation.)*

TEACHERS' MANUALS.

Outline of Drawing Lessons for Primary Grades.
Outline of Drawing Lessons for Grammar Grades.

DRAWING CARDS.

National Drawing Cards for Primary Grades.

DRAWING BOOKS.

One book each for the 4th, 5th, 6th, 7th, and 8th years of school.

SPECIAL MATERIAL FOR THE NATIONAL DRAWING COURSE.

The Cross Transparent Drawing Slate.
The Cross Pencil for use with the slate.
The National Drawing Models.
The National Model Support or Desk Easel.

National Drawing Books

COLOR STUDY

A MANUAL FOR

TEACHERS AND STUDENTS

BY

ANSON K. CROSS

Instructor in the Massachusetts Normal Art School, and in the School of Drawing and Painting, Museum of Fine Arts, Boston. Author of "Free-Hand Drawing, Light and Shade, and Free-Hand Perspective," and a Series of Text and Drawing Books for the Public Schools.

BOSTON, U.S.A.
GINN & COMPANY, PUBLISHERS
1896

PREFACE.

THESE notes are intended for teachers and others who may wish a brief statement of some of the most important theories of color. They do not present new matter or new theories. Their aim is, first, to show that color perception is æsthetically and educationally more important than color theories, and that correct theories can come only from a generally increased power to perceive color sensations; second, to give to public-school teachers suggestions which may assist them to create in their pupils a love for color and a power to see the delicate and beautiful effects which Nature presents.

The public-school teacher should not attempt to present color theories to primary or grammar-school pupils, but she will not be able to present the subject in a simple and interesting manner if she does not possess general information beyond the facts she may state to her pupils. The first part of this book briefly explains some of the most important facts relating to color, which will assist teachers to awaken in their pupils the idea that Nature's colors are always changing.

It is not claimed that the work here suggested for the public schools is the best possible course, but only that it forms a good basis for experiments, which will lead to more satisfactory results in color work.

Those who wish more than the brief outline of the two leading color theories given here, should consult Rood's *Modern Chromatics*, *The Theory of Color*, by von Bezold, and George Field's works on color. Those who desire more information

on the contrast and arrangement of colors will find Chevreul's and von Bezold's works interesting and valuable.

Although study of these theories will show how absurd it is to expect to produce by theory alone a work of art, yet it will give general principles which will be of value in assisting one to perceive color effects. To create beautiful color or art in any direction requires genius, and genius is repressed or killed by the rigid and imperfect rules of any school.

ANSON K. CROSS.

CONTENTS.

PART I.

PART II.

PART I.

CHAPTER I.

COLOR STANDARDS.

In order that the following pages may be understood, the definitions given at the back of the book should be carefully studied for the meanings of the different color terms used. Of these *local* and *apparent* are especially important.

By local color is meant the color which any object appears when it is so near the eyes that its color is not changed by the atmosphere, and it is seen under pure white light, and does not reflect colored light from objects situated near it.

By apparent color is meant any appearance of color which is not the local color. The appearance of any color is changed by the atmosphere, by a colored illuminating light, by reflected lights, by contrast, by light and shade, and by other causes, all of which may act singly or combined.

Color is of all qualities the most difficult to see. We do not mean local color, that is, the absolute color of an object, for this is without doubt about as easy to realize as the actual forms of objects. As in outline drawing, the difficulty is to see the apparent form of the object, which is rarely the real form; so in color, the difficulty is to see the apparent color, which, as seen in Nature, may be said never to be the real or local color.

Some eyes distort the image of form so that the full moon, for instance, appears an ellipse instead of a circle. With color there is much more distortion. It is well known that many people are color-blind. There are different forms of color-blindness: some, for instance, may see the green and the red rays only; others, the green and the violet; some may see two colors perfectly, and a third im-

perfectly; and others may see all imperfectly. There is every probability that color-blindness may be to a slight extent very general. Total color blindness, as generally understood, causes all colors to appear as different tones of neutral grays.

Such a defect, or the failure to see to a large extent any color or colors, may be readily discovered, although experiments have shown that many persons thus affected have grown to maturity, and engaged in occupations requiring color perception, without having become aware of their deficiency. If this can happen when the defect is marked, how little chance there is that the person who is only slightly affected by this trouble will ever realize that he does not see as much color as another person! That most people are more or less color-blind is proven by the fact that until very lately even the artists, whose entire study is that of color and color as it appears, not as it is, have been blind to the color in Nature. If not blind so far as actual perception of the color is concerned, then they certainly have absolutely refused to paint the colors which they have seen.

Originality, that capacity which enables us to assimilate ideas, is very rare. At times, for centuries almost, it has seemed to be entirely dormant; at other times more common, it has led to the awakening of ideas which have produced the great epochs of the world's history.

For centuries artists have been satisfied to paint as their masters painted. Art was reduced to a system, and an individual perception of the color that Nature presents was not reached until the latter part of the nineteenth century.

If artists saw color with the eyes of their masters, the public saw color with the eyes of the artists; and thus it has happened that, up to within a very few years, the idea that Nature's color-effects are very different from the local colors, and are not dull and heavy, has not arisen to cause the public to question the standard, so long accepted, — that good painting must be in quiet and subdued colors.

The fact that a mirror reflects light and color rarely occurred to the painters before Turner; or if it did occur to them, they did not see that every object in Nature is to a greater or less extent a mirror. Most objects resemble mirrors to a very large extent; for every surface reflects light, and every smooth surface reflects a large amount

of the light it receives. On a rainy day it is almost, if not quite, impossible to discover the local color even in objects that are near.

It is almost beyond belief that for hundreds of years painters should have persisted in representing every shadow by a muddy brown or dirt color, when their eyes have said to the incredulous brain, "The shadow is bluish." It is hard to realize that painters should not have seen that a horizontal mirror upon the sand at the seashore, in the shadow of some object, must reflect the blue of the sky; and that, seeing this, they should not have discovered that the white sand is composed of grains of rock, whose faces are smooth and polished mirrors, which together form a mirror capable of reflecting a large part of the blue reflected by the glass mirror.

Realizing the fact that it has taken so long for artists to discover that color as well as form is changed by the act of perception, the public should not think it strange if the colors now seen by painters are invisible to those whose color perception is due to false education and standards.

In order to show the difficulties investing any attempts to reduce color to a science, we refer to the present awakening in the direction of color, which has led to much that is absurd and ugly, especially from the hands of artists who have been forced to change their style much against their wills and entirely without an understanding of the real principles involved.

Even as regards the absolute or local colors of objects, a scientific classification is impossible. Nature gives us no fixed and unchanging colors; she gives us no complete scale of colors. The spectrum, which is the nearest to this, is incomplete in colors and hues; not only this, but its colors change with the hour of the day and the state of the atmosphere. In pigments we do not find a single pure color.

If we attempt to create a standard, who shall be the judges? We do not know to what extent we are all color-blind, and we certainly shall not find that amateurs, scientists, or artists, will agree even within the limits of their own professions. If we should put the matter to a test and compel, or in any way obtain, the opinions of all the artists, for instance, the majority to decide, who can say that the majority might not be composed of those who have,

in greater or less degree, color-blindness in its most common form? This vote would certainly decide nothing, for the minority would see and paint color by their own eyes or by traditions, as they might happen to work. The matter would be decided no better by the public. Artists and the public have been equally blind in the past, and although, in the matter of real or absolute color as distinguished from apparent color, it is without doubt possible to decide upon and name certain colors as the standards, it is a question if educationally the result will pay for the worry and trouble involved.

In this connection the investigations of Chevreul are of interest. His experiments were made to discover the best harmonies of color, and the best applications of color in industrial art. He depended upon his own color-sense and upon that of trained assistants, and for twenty-five years made the most elaborate and careful experiments to discover the action of colors upon one another.

The theories presented by Chevreul are based upon the pigment theory of color, and we find that even the patient study and trained observation of Chevreul and his assistants were insufficient to relieve the judgment from the dictates of this theory. He failed to see that the mixture of blue and yellow, obtained by viewing at a distance narrow stripes or threads of these colors, gives gray, and not green, and that when colors are mixed in this way, the result is different from the mixture of pigments. That Chevreul, who made this study his business for twenty-five years, failed to discover this, shows how strongly theories affect even the most patient and honest perception.

In the practical use and application of colors, industrially and otherwise, a standard of names will be of great assistance; but educationally and æsthetically the name of the color is of no moment. The beauty of a landscape is in no wise affected, whether the name of the blue sky is blue or yellow. The perception of color is the important thing. The names of colors are of so little consequence that many artists have no idea of the popular nomenclature, and when it comes to the practical mixing of the colors to give an effect, an artist of experience will rarely be able to name his combinations.

Nature in all directions works by law, and these laws are being discovered all the time. It would be absurd to state that there is no

science of color, and that the laws of harmony, contrast, *etc.*, cannot be written. Without doubt, in process of time, evolution will make man a more perfect master of matter than he now is, and cognizant of much that is now mystery. Theories of all subjects have changed and are constantly changing. New facts of discovery often prove accepted theories untenable as soon as they have come to be generally accepted. In this matter of color, it seems unwise to spend energy upon the search for theory before ability to see color is acquired. Theories are generally the outgrowth of facts observed; and in color, as in other lines of investigation, it will not be unlikely that, after the color sense has been so educated that true color perception is the usual instead of the unusual thing, the capacity to see color will enable a choice to be made of the best standards and of a satisfactory theory of color.

At present teachers are spending time in the search for standards and for working theories of color. If instead of trying to do what is of the least practical value, the attempt should be made to give pupils the ability to see the actual colors, and then, beyond these, the apparent colors, or the changes effected in the actual color by transmitted and reflected lights, we believe that the color sense would be so developed that the average man would become able to enjoy the poetry of Nature, — to which he is now blind because he has never discovered that he does not see the local color facts which he knows about objects.

It is urged that, as new truths are daily being discovered by men who have not hitherto been regarded as learned, it is not impossible that we may yet see Newtons and Edisons in art, who shall be able to make the public appreciate the great mysteries of the beautiful. This is a popular idea regarding not only art but other subjects; but those who argue thus seem to forget that color perception, as well as all that is valuable to the higher nature of man, must come from within, and cannot be bought or even accepted as a gift. Nature's laws cannot be circumvented, and these laws prescribe that all which is of value is the result of gradual growth. An Edison in science discovers a principle whose action is shown by the machine which produces results that can be appreciated by all; the results are visible as force or matter which all can see, even without knowl-

edge of the scientific principles governing these results. An Edison in art produces work which is fully appreciated only by those who are nearly, if not quite, his equals in ability to feel if not to execute. The public has always derided the efforts of artistic genius, which is not strange, since in the nature of things it is impossible for all men to be created, or to become, equal in capacity.

It is said that the laws of music have been formulated after continued effort, and that in art similar results may be obtained. It is admitted that the theories of music were not discovered for ages after the music was produced, the study of which evolved the theories: yet at the present time, with almost no light on the subject of color, many are expending their energy in the search for theory. With color the matter is far more difficult than with music, for good music — the best music — is heard by a large part of the public from childhood, while in painting, the popular art is the bad art. If the best music was for so long in advance of understood laws, how imperfectly the color theories now formulated must accord with the best art!

Chemistry is cited to show that what has been regarded as mysterious may be reduced to a science. But chemistry deals with atoms and the material elements; art deals with the soul, the spiritual, and must not be confused with the canvas and the paint upon it. It is as much more difficult to analyze as the soul is more subtile than the body.

Instead then of disputing as to whether the spectrum shall give the accepted standards of color, or whether the standards shall be selected or designed by the artist, teachers will do well to use the spectrum or any examples of color simply for study of the colors which they furnish. There is little difficulty in naming the colors in a broad way so that they shall be generally recognized and accepted as red, blue, yellow, violet, green, etc. At present there is no possibility of doing more than this, or of exactly defining the combinations which are complementary, harmonious, etc.

In "The Student's Text-Book of Color" Mr. Ogden M. Rood says: "In the first place we have no pigments with which we can at all properly represent the colors of the spectrum, even when their luminosity is quite moderate; our best pigments all reflect more or less white light mixed with their colored light. If with their aid we

undertook to construct a color chart, we should not only be obliged to descend in the cone a good distance towards its black apex, but besides this, our chart would be smaller than the section of the cone at that point, owing to the presence of the foreign white light reflected by the pigments. It would be next to impossible to prepare pigments of different colors suitable even for the production of a single chart of the series, for it would be necessary that they should be right in the matter of hue, luminosity, and greater or less freedom from white light." Again, speaking of the color chart of Chevreul, he says, "The ideas upon which this chart is based are not only in the main arbitrary, but also vague, and the execution of the sample examined by the author left much to be desired. We cannot regard this color chart as a true step toward a philosophical classification of colors, but rather as a more elaborate repetition of the work of Mayer, Lambert, and Runge. In point of fact, our knowledge of color and our means of experimenting on it are not at present sufficiently advanced to enable us even to propose a plan for a truly philosophical classification, and between the proposal and its execution there would be many weary steps."

To appreciate fully the above, it will be necessary to read Mr. Rood's book, which is a clear and interesting presentation of the light theory of color; some idea, however, of the difficulties involved in the selection of standards of color will be gained when it is stated that the spectrum contains at least 1,000 distinguishable tones which may be made 100,000 by slight variations in the power of the light producing them, up to a brightness five times as great as at first. A diminution in the luminosity of the light will produce corresponding variations in the tones, and if these tones of colors be changed by varying admixtures of white light, the number of distinguishable tones will be carried into the millions.

In addition to the almost infinite range of colors is the difficulty that colors which, under a given illumination, have a certain relation to each other (as for instance equal degrees of luminosity), under another illumination have entirely different relations; but this matter of the change of colors will be considered by itself, as we think it has been sufficiently shown that perception of color and not color science should be the first aim of the teacher.

Art and science have such entirely different foundations that comparisons of methods are harmful to both. Art has, however, a scientific side; thus the facts of form and the perspective appearance of form belong to the domain of science. They are absolute and very different from color appearances. Study of local color is as necessary and valuable as study of actual form, and may foster artistic color genius, as much as study of the facts of form assists in their perspective representation. What we object to is the idea that the study of rules will produce art when its germ is not already in the soul; to the study of color facts only instead of the study of color appearances, and the attempt to teach rules and theories before any power to see color has been cultivated.

CHAPTER II.

COLOR APPEARANCES.

THE local color of an object is rarely the color which the eye sees. This point is so important that special consideration is given to it.

The amount of white light which is reflected directly from any surface depends entirely upon the nature of the surface. When the surface is smooth or polished, as that of water and many mineral substances, a large part of the light is reflected directly. The polished surface of a perfect silver mirror reflects 92% of the light which falls upon it. The light which is reflected from the surface of a mirror is simply changed in direction, and a perfect image or picture of the object which reflects the light is produced, the surface of the mirror not being visible. If the surface of the mirror is warped or slightly defaced, the light is reflected irregularly, and the image of the object is correspondingly warped. If a reflecting surface is not perfectly polished, it becomes visible, and the image of the object reflected is dimmed and broken, for the rays which strike the roughened parts of the surface are not reflected so fully as the others; besides this, the reflected rays are reflected in different directions and not so that the angle of incidence is equal to the angle of reflection. The rougher any surface is, the less light it reflects and the more irregularly it reflects it.

The rays of light which strike the surface of any object are divided, part of the rays being reflected directly from the surface. Every object, no matter what its actual color, thus reflects a certain amount of white light. A perfectly black object reflects part of the light which falls upon it; therefore there is a light side and a shadow side to even the darkest object.

The rays which are not reflected directly from the surface of the object enter the object to a distance which depends upon the nature of the object, and are then affected by the color of the object so that when they are turned back and reflected in all directions from the

surface of the object, they are colored. Every object not white or black reflects these two kinds of light: a colored light which is reflected in all directions, and white light which is reflected from the surface of the object more or less regularly, according to the nature of the surface.

The rays are reflected regularly from polished surfaces, and irregularly from those not polished; hence a very slight change in position will entirely change the appearance of the polished object; but as the rays are reflected from the rough surface in all directions, its appearance will be much less varied by changes in the position of the observer.

Every object reflects not only white light or sunlight, but also the colored light which is sent out from any object situated near it. This colored light will be acted upon by the object just as is white light: part will enter the surface, and part will be reflected directly and unchanged in color from the surface. This colored reflected light will mingle with the other rays sent out by the object, and color them to an extent which depends upon their strength and upon the polish of the surface reflecting them.

As every object reflects some of the light which falls upon it from every other object, it follows that we can see the local color of an object only when it is situated so that it does not receive the colored rays sent out by other objects. Theoretically this is impossible, but practically, when an object is near the eye and far from other objects, and when the surface is not very smooth, the colored rays which it will reflect will be so few that they will not perceptibly influence the appearance; hence we may speak of the local color of an object, and practically often see it in objects that are near.

The influence of these reflected and colored lights has rarely been rightly estimated by art students. The reflected colors in Nature are often stronger than the local colors, even when the object is near. Thus a polished cherry chair of a strong red color reflects so much of the light of the sky as to appear blue in places, and any color may in the same manner be entirely lost in the stronger color reflected from some other object or light.

It is not necessary that the object or color reflected be near the object. If the light sent from it is strong, and the reflecting surface

is polished, the local color of the object will not be seen. The most frequent powerful change of color by reflection alone, occurs in those parts of the object which reflect light most directly to the eyes, and more particularly in those upon objects which are smooth enough to glisten.

In Nature, leaves, grasses, etc., reflect so much light to the eye that the local color is rarely seen. It has been previously shown that the shadows cast upon yellow sand appear blue. Part of this effect is due to the yellow of the sand, which adds its complementary blue to the shadow; but this is only part of the cause, for, the direct rays of the sun being cut off, the sand can reflect only the indirect rays, and these must come largely from the blue of the sky. The bright green leaf often reflects so many of these rays from the sky as to appear a decided blue, and this blue will be seen on every surface which is at such an angle as to reflect to the eye the rays which come from the blue parts of the sky.

Surfaces which are less glossy than leaves reflect less of the colored light; but all surfaces reflect enough to largely modify the light due to the local color.

The surface of water reflects as much light as a mirror when the angle at which the light strikes the surface is very small. This, in connection with the fact that the light from directly overhead is a much more intense color than that from near the horizon, accounts for the fact that the surface of water near an observer is so much darker than that in the distance. The art student who has not discovered that the colors he sees in Nature are transient and not local colors, has great difficulty in seeing the color of water when it does not reflect a clear blue sky; and until his eyes are trained to see color, he is obliged to look at the objects or colors which reflect in the water before he can recognize the colors of the reflections.

Perfectly clear water reflects the colors near it unchanged, except for a slight loss in brilliancy; muddy water changes the color of the reflections; therefore in Nature the colors which water may appear to have are infinite, and their study is the best training in color perception.

The color of the lightest part of any smooth object is a reflection of the color of the source of the light. Thus a red polished chair, whether outdoors or indoors, situated so as to reflect the blue

light of the sky into the eyes, will appear blue in parts. It will appear gray when it reflects an overcast sky, yellow or orange when it reflects into the eyes the rays from the setting sun, or the sky about the sun; and silver or whitish when it reflects directly into the eyes the rays of the sun at midday.

The color of the lights — the lightest parts — of any object is thus changing with the color of the strongest illuminating light, and may entirely hide the local color of the object. The parts of any object which reflect light less directly to the eyes will be less affected by the change in the color of the light.

When an object is not polished, its color is of course much less changed by the color of the illuminating light; but all objects owe their color directly to this light, and any change in its color is at once apparent in the change of the color of the objects seen. A yellow day and the sunset effects are the most prominent and easily appreciated illustrations.

Reference to these common effects of Nature, which are strong enough to be seen by all who are not wholly color-blind, will assist to an understanding of how, under normal light, sunshine, or gray day, all objects act upon each other, and reflect some of the colored light which they receive from each other. The simplest experiment to prove this fact will be the placing of a flat sheet of plain colored paper and an unframed piece of mirror of the same size together, at an angle of about 90 degrees, so that the mirror and the paper may be seen at the same time. At a distance of a few feet it will be found impossible to say which is the paper and which the mirror. If instead of the mirror a sheet of plain white paper be placed against the colored sheet, it will appear tinged with the color of the colored paper, the color being strongest near the line of meeting. The sheet of white paper should be considerably higher than the colored, in order that the white paper may be seen above the part which is tinted by reflection. If different colored sheets are held against the white, and if the light is strong and strikes full upon the colored papers, there will be little difficulty in seeing the effect which the colors produce upon the white paper.

If, instead of white paper and colored paper, two sheets of colored paper be used, the change in the color of each, due to the

colored light reflected from the other, will be less apparent to those whose eyes are not sensitive to color; but all will understand that the color which was reflected from the white paper must have its effect upon the colored paper.

The effect of reflected light upon the local colors of objects has been shown to be very powerful. The action of such light upon the shadow side of objects is not less powerful. In fact, the shadow side, since it reflects less light than the light side, must be more changed by light reflected from any colored object than the light side when it reflects the same amount of colored light. An orange or other bright object will reflect in a surface which is unpolished strongly enough to entirely change the color of the surface, and when the surface is polished it gives a reflection of the form of the object with most of the color.

The change in color due to the reflection of a bright object in one which is smooth, or the reflection of any color in an object which is polished may be as great as the change in color due to the illuminating light being reflected directly into the eyes by polished surfaces.

Color is due to light, and it is evident that a change in the strength of the light must change the effect of colors. Strengthening the light thrown upon colors lightens them. Decreasing the light causes colors to appear darker, and the changes which may thus be effected are infinite in range and variety.

With uniform light, changes similar to those produced by decreasing the light are found when the surfaces are so situated as to reflect unequal amounts of light to the eyes. In Nature this is the rule, and objects are seen through the light and shade and color effects thus produced.

The sphere has a surface which passes gradually from the point upon the surface which reflects light directly into the eyes, to the line upon the surface from which no direct light is reflected to the eyes; thus the white sphere gives a large number of tones, from the highest light to the deepest shade; and we see at once that a white surface may present many different appearances. In the same way a colored sphere will present many different tones of color, from the lightest tint of the color to the darkest shade. The appearance of any color depends, therefore, upon the amount of light which it

receives. In the sphere the transition from light to dark is gradual; but if a cube be exposed to light its various surfaces will reflect the light unequally, and one at least of the visible surfaces will often receive no direct rays; in this case the separation between the surfaces will be sharply marked, and their difference in color (value) will be great.

The change in color caused by shadow and contrast is often so great as to cause the color to appear some other color. All colors may be so changed by strong shadow or cast shadow as to be unrecognized when the light surfaces which show the local color are not visible. This change is due to the absence of direct light, to the effect of *contrast*, which makes the strong color visible in the light surfaces add its complementary color to the shadow side, and also to the action of colored light reflected from other bodies. The strongest of these causes predominates to change the appearance of the color as it would appear if influenced simply by loss of light.

The changes of color due to colored lights reflected from other bodies have been shown. Changes of color are also produced by light transmitted upon any body through any substance which colors the light. The strongest effects of this nature are given by stained glass, but many substances allow a small amount of colored light to pass through them, and this affects the color of objects upon which it falls. The most common and beautiful effects of this nature are those of sunrise and sunset. At these hours the rays of the sun pass horizontally through the air surrounding the earth, and thus they traverse many more miles of air than at other hours of the day. The differently colored rays are refracted unequally. The red and orange rays are bent more than the other rays by the particles in the air. Thus, the atmosphere is a medium which transmits colored light, which causes all that it strikes upon to appear orange and gold, and makes the shadows and cast shadows appear, by contrast and reflection, violet and purple.

Changes due to different causes acting upon objects near the spectator have been shown to be powerful; but the changes due to atmosphere are more frequent, if not generally stronger. The changes in local color due to rich sunset effects are seen by nearly

all, but very few realize that the changes are as great in a more delicate key, whether due to sunlight or gray day effects. The particles of smoke, dust, or vapor which the air contains always reflect colored light to the eyes. This colored light mingles with the light sent from distant objects, and thus their colors are changed; the more numerous the particles in the air, the greater are the changes.

Substances which are translucent are very greatly changed in color when they are placed so that the light passes through them in coming to the eyes. Thus, leaves which appear a weak green seem the most brilliant green or yellow when they are between the sun and the eyes. A sheet of gold leaf, when held between the light and the eyes, allows enough light to pass through it to cause its color to appear a bluish green; and changes of this nature in many objects are very frequent and powerful.

Another change of color of frequent occurrence is due to the fact that when small bits of different colors are seen from a distance, they lose their different forms and colors, and blend together to form a color effect which depends upon the nature of the colors thus blended.

Small bits of color in Nature are thus continually being blurred into different and richer colors, for the blending of the rays sent out by the different colors gives a true light mixture. In Nature these effects are produced under the action of a light many times more powerful than the light by which pictures are seen. The different spots of color in pictures send lights to the eye which blend in just the same way as do the lights from the different bits in Nature; but the light under which the picture is seen is generally so much weaker than that under which outdoor objects are seen that, if the actual colors of Nature are represented, they will in the feeble light fall far short of the effects observed in Nature.

The attempt of the present school of impressionists is to correct this appearance by using colors which are light enough, and which act upon each other by contrast powerfully enough to give the desired effect in the subdued lights in which they are to be seen.

Another change is produced by the action of two or more lights of different colors. Thus an object may receive outdoor light and lamplight at the same time. The effects of contrast due to such

illumination are very strong, and the local color of the object will be greatly changed, if not entirely lost.

Different colors are affected differently by a change in the strength of the light. The warm colors grow dark much more rapidly when the light diminishes than do the cold colors; hence the appearance and relations of colors may be completely changed in this way.

Other changes of color are due to the fact that some substances have the power of changing the wave lengths so that light of a certain color falling on these substances will be reflected of an entirely different color.

From what has been said it will be seen that the actual or local color of an object is very seldom seen, and we may question if there is such a thing as color which is absolute and capable of measurement. For the artist's purposes local color is a fact, although a fact which does more harm than good, since he sees the local color so seldom that if it did not exist, and if all colors were changeable like the colors of a chameleon, he would be much better off; for then he would not think of any color or expect to see it, and he would see the actual appearance of the color instead of the color as he knows it, or as he thinks he ought to see it.

One of the highest pleasures to be derived from observation of Nature is due to color sense, trained to see the infinite variety and gradations of the beautiful colors which she presents. Any outdoor subject is always interesting through its different color effects. Its form and light and shade effects are varied with the hour of the day, and with every change in position of the observer; but the color is changed to a greater extent, for, without any change in position of the observer, the sun, the source of light and color, and the atmosphere combine to give a never-ending succession of effects, which speak of the beauty of the earth and the grandeur of the universe of which it is an atom.

At midday, when the sun is shining brightly, we find clear and intense the blue of the sky, stronger the blue of the water, and bright and strong the colors of sand and marsh and forest. These colors do not give the highest delight to the most sensitive, who are more pleased by the soft colors of morning and evening, by the mysterious grays, and by tints which veil the actual colors of all things. The best opin-

ion is agreed upon this point; and also upon the fact that these beauties are lost to the majority, who always see through Nature's beautiful veils the actual colors which they know exist in what is observed, and who, if they fail to recognize the object for any reason, are entirely at a loss as to what the color effect of the object is. From Nature such people draw only facts; all her beauty, her poetry, her mystery, are to them as if they did not exist.

In his *Ten O'Clock* Mr. Whistler says: "The dignity of the snow-capped mountains is lost in distinctness, but the joy of the tourist is to recognize the traveller on the top. The desire to see for the sake of seeing is with the mass alone the one to be gratified, hence the delight in detail. And when the evening mist clothes the riverside with poetry, as with a veil, and the poor buildings lose themselves in the dim sky, and the tall chimneys become campanili, and the warehouses are palaces in the night, and the whole city hangs in the heavens, and fairy-land is before us — then the wayfarer hastens home; the workingman and the cultured one, the wise man and the one of pleasure, cease to understand, as they have ceased to see, and Nature, who for once has sung in tune, sings her exquisite song to the artist alone, her son and her master — her son in that he loves her, her master in that he knows her."

That these delicate colors, which will be readily accepted by all as subjective colors, constitute the most refined harmony, is the belief of our painters. That these colors are difficult to see is shown by the present art impulse called impressionism, which was anticipated by Turner years ago. Turner was crazy or became color-blind, so it is said; yet his paintings are now admitted to be the first of the school which illustrates the fact that Nature is colored, and that color cannot be represented by bitumen and other browns. This point, which is now realized quite generally for the first time by painters, leads us to expect that in time the public will learn to see color, and that in artistic work it will be at least as important as any other quality, and probably more important than some.

This step will be hastened by the study of color in the school-room, for good taste in art is rare and very difficult to cultivate. It is largely a matter of growth under the influence of those who are most refined and susceptible to the beautiful.

The child who is surrounded by crude and gaudy colors must be educated to a low standard of the beautiful. The same child surrounded by beautiful colors in good harmony, will often become refined in taste. It is natural that the bright colors should attract the young child, who, if not brought to study and perceive more delicate colors, will very likely never become able to see them. The color sense is like any other power, which, if not exercised, is lost, and which can never be fully possessed without special training and effort.

The difficulty of obtaining harmony in the primaries leads some to believe that this harmony is most desirable, and that the study of the primaries should be continued for a long time. It is true that the richest color effect is obtained by the blending of bright colors by distance, as they are blended in Nature, and by the art of the most modern painters; but the number of colors studied should be increased as rapidly as possible, and harmony in the primary colors should not be attempted in the lower grades.

The historic ornament executed in primary and bright colors must frequently have produced the effects obtained by modern painting through the juxtaposition of color, the individual spots of color being lost in the rich color-effect produced by blending through distance. Teachers, however, who are introducing these colors for designs not intended to be seen as was the original ornament, are losing sight of the important principle that good design should be fitted to its place and purpose, and that when transplanted without regard to this principle it may be good no longer. The pupils of the public schools must begin with bright colors; but this is not a good reason for withholding study of the tints, shades, and hues of color, which must train the eye to see the delicate color effects that Nature presents.

The study of colors affected by transmitted and reflected light ought to be an important part of the training in the upper grades of the public schools; for, unless the student can be made to realize the fact that colors are changed as described in the present chapter, there is little chance of his ever seeing in Nature more than the crude and positive color facts which he knows about all that he sees, and which are obvious to the most uncultivated.

CHAPTER III.

COLOR THEORIES.

The Light Theory.

MANY different theories of light and color have been presented. At present there is no agreement upon the matter, and, as color theories are not necessary to the perception of color, time spent upon the study of theory in the grammar grades would be much better spent in almost any other direction.

Though theories are not necessary to color perception, a brief study of the two most important theories will be interesting to the teacher, and a little practical study of the pigment theory of color will be interesting and valuable to all the pupils.

The following is a brief outline of the theory as presented by Helmholtz, von Bezold, and O. N. Rood in his *Students' Text-Book of Color.*

Light travels in straight lines by means of vibrations transverse to these lines, which are called waves. The lengths of these waves vary. The rays of light from any object enter the eye and are focussed on the retina at the back of the eye. The retina consists of sensitive nerve elements which are acted upon by the light waves. Waves of different lengths give different sensations of color. The longest rays give the sensation of red, the shortest that of violet, and between these extremes is a series of waves of intermediate lengths, which correspond to the colors of the rainbow found between red and violet; namely, orange, yellow, green, and blue. Other colors are given by a mixture of waves of different lengths, and the sensation of white is produced by a mixture of waves of all the different lengths.

An endless variety of hues can be produced by mixtures of different wave lengths. Some colors can be made by the mixture of

others; colors which cannot be produced by mixture are called the primary colors, and from them all others may be produced.

Light of different colors may be easiest mixed by means of the simple contrivance shown in Fig. 1.

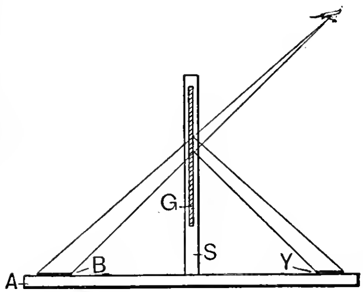


FIG. 1.

A represents a board having a dead black surface, with uprights, *S*, in the centre at each side, supporting a piece of clear glass, *G*. If a piece of yellow paper be placed at *Y* and a piece of blue at *B*, the eye may be made to see the blue through the glass, and, at the same time, the yellow by reflection from the glass. By shifting the eye or the papers the reflection of *Y* may be made to cover the blue piece, when the color produced in the eye will be white or a neutral gray, according to the purity of the colored papers. By means of repeated experiments with other colors, it will be found that the primary colors are red, green, and violet; that is, by a mixture of light of these three colors all the other colors can be obtained.

By experiments it will be found that mixtures of the light colors of the spectrum, from red to yellow green, also mixtures of the colors of the darker end of the spectrum, from bluish green to violet, give colors resembling those mixed.

If the primaries are mixed, the colors resulting do not resemble the primaries. Thus:

Red and green light produce . .	orange or yellow.
Red and violet light produce . .	purple.
Green and violet light produce . .	blue.

The cause of these different color sensations cannot be found in the rays, whose only difference consists in the different lengths of the waves. The theory of Young is that there are three different kinds of nerve elements in the retina, which are differently affected by the waves of different lengths. The longest waves act strongly upon the

first set of nerves and produce the sensation of red. Waves of medium length act strongly upon the second set and cause the sensation of green. The shortest waves act strongly upon the third set and cause the sensation of violet.

Each set of nerve elements is acted upon powerfully by waves of one length and to a slight extent by waves of other lengths, so that the waves which cause the sensation red produce at the same time a slight sensation of green and of violet. The power which the different waves exert upon the different kinds of nerves is shown by Fig. 2, which is by Helmholtz.

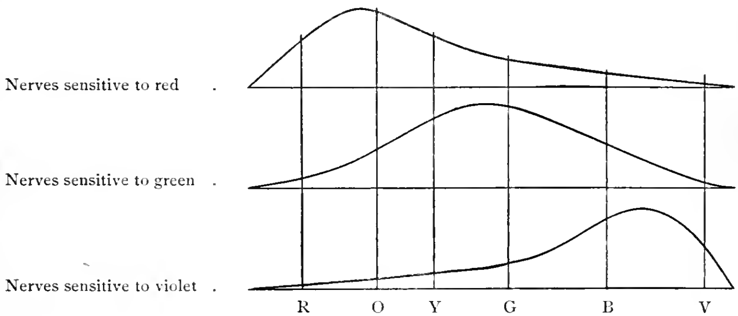


Fig. 2.

The letters R, O, Y, etc., indicate the colors red, orange, yellow, etc., and the curved lines show the action of these colors upon the different kinds of nerve elements. The diagram shows that the longest waves (the red) act powerfully upon the first set of nerves, less powerfully upon the second, and slightly upon the third. The waves of medium length (the green) act powerfully upon the second set, and less powerfully and about equally upon the first and third sets, while the shortest (the violet) act strongly upon the third set and feebly upon the first and second. Waves intermediate in length between those producing the sensations red, green, and violet act more evenly upon the three kinds of nerve elements. By exciting the three kinds at the same time to different degrees, all the different color sensations are produced. When the three kinds of nerve elements are acted upon equally, white light is produced.

Complementary Colors.

Any two colors which by their union produce white, as in the case of blue and yellow, are called Complementary Colors. Such colors give the strongest possible contrasts.

The best simple means of combining colors is by the use of Maxwell's disks. When two colors thus combined give the effect of a perfectly neutral gray, they will be practically complementary.

The color disks of Maxwell consist of circular sheets of colored paper which are cut on a radius so that two or three may be placed together, and any proportion of each be shown. When the disks are revolved rapidly, the colors are blended and give the color which is the result of the light mixture of the colors of the disks. An infinite number of tints, hues, and shades of all colors can be obtained by the use of these disks upon a color wheel, and the perception and identification of the colors thus formed give the best possible training for the pupils. The pupils should not study the light theory of color when they work with pigments, as it will only tend to confuse them. For this reason the cards used should not be seen except when they are in motion. Blue and yellow disks revolving produce white (gray), but blue and yellow pigments give green, and the lack of agreement between the two theories will be very confusing to pupils who are using pigments. Before the wheel has stopped revolving, a card or sheet of paper may be placed so as to cover the colors used; and when the cards are shifted, it should be done behind a screen, or when the disks are turned from the pupils.

By means of experiments with these disks, it will be found that if two colors, as green-blue and vermilion, are complementary, the vermilion may be mixed with black or with white in different proportions, and still be complementary to the green-blue. Thus a color may have many different complementary colors.

The complementary colors are as follows: *

Red and green-blue make	white.
Orange and cyan-blue (greenish blue) make . .	white.
Yellow and blue make	white.
Green-yellow and violet make	white.
Green and purple make	white.

* From Rood's Modern Chromatics.

By the use of Maxwell's disks, the following pigment colors are found to be complementary: *

Carmine	Blue-green.
Vermilion	Green-blue.
Orange	Greenish blue.
Yellow	Blue.
Greenish yellow	French-blue.
Greenish yellow	Violet.
Green	Purple.

The sensation of white can be produced by different mixtures of two colored lights, or by mixtures of more than two colors; thus, the colored lights of the spectrum may be combined to produce white light. The mixtures produce the same impression on the eye, but in other respects they are unlike. A surface lighted by red and green-blue lights will come out black in a photograph, while another lighted by greenish-yellow and violet will come out very light. To the eye both surfaces appear white. All these different mixtures excite all three of the nerve elements equally, and thus appear white.

According to this theory, an eye in its natural state never sees a pure color; as the red, for instance, of the spectrum, besides its action on the red nerve-fibres, excites slightly the other two sets of nerves, and thus the sensation of red is slightly mixed with violet and green. The nerves of the retina are very easily tired, and are then not sensitive to color. By wearing glasses of a strong greenish blue color, all the red rays will be prevented from reaching the eye, which will, after a time, become insensitive to the violet and green rays; then, if the spectacles are taken off, these rays no longer being seen, the eye will see the red of the spectrum much purer and stronger than when seen under normal vision. Only under such conditions is it possible for the eye to see pure red, and the same is true of other colors.

The Pigment Theory.

Red and yellow pigments combine and form orange; yellow and blue make green; blue and red make violet; and by combining the

* From Rood's Modern Chromatics.

pigments red, yellow, and blue in different proportions, it is possible to obtain all hues of all colors.

Red, yellow, and blue are thus called the primaries. The combination of any two primaries gives a secondary; these are orange, green, and violet. Any two secondaries combined give a tertiary. Thus,

Orange	and	green	combined	give citrine.
Green	"	violet	"	" olive.
Violet	"	orange	"	" russet.

As already shown, part of the rays of light striking any colored object are reflected from it unchanged. The other rays enter the surface, and are then turned back and reflected from the object minus certain rays which have been absorbed by the object. It is evident that as part of the rays which compose white light have been absorbed, those which are reflected must be colored. The color produced by any pigment is due to the absorption by the pigment of all the rays except those forming the color which it appears. If two pigments are combined, the resulting color is due to the rays which are not absorbed by either pigment. It follows that pigments destroy light, and that the mixture of red, yellow, and blue produces black by the absorption of all the rays of light.

The mixture of blue and yellow pigments produces green, because the blue pigment absorbs all the red, orange, and yellow rays, while the yellow pigment absorbs the blue and violet rays. The green rays, being the only ones not absorbed, give the color of the combination.

Two colors are said to be complementary when together they contain the primary colors in the proportion of 3 yellow, 5 red, and 8 blue.

The results of pigment combinations are very different from those obtained by combining rays of light, and for this reason it seems unwise to bring into public school work the light theory by the use of Maxwell's disks or other apparatus. Knowledge of the practical use of pigments will be of value to all the pupils. Knowledge of the light theory will prove interesting, but can be of little practical value to most of the students, and the study of this theory should not be taken up before the high school. The study of either or of any theory can never give love for color, or the ability to see color.

Study of the pigment theory will not help the artist to any great extent, for the pigments used are so varying and act so differently upon one another, that he soon learns to mix his colors by eye and feeling, and not by rule or theory. This theory does, however, assist the pupil in his first attempts, for any blue and yellow combine to produce some effect of green, and all combinations of the primary pigments agree approximately with the pigment theory of color. Adding red or yellowish color to any combination always makes it warmer, while the addition of a blue always makes it colder and darker. In such ways the pigment theory of color will aid the pupil in the public schools, who at best cannot be expected in the grammar grades to go beyond those simple experiments in pigments which will give ability to match flat tones of color, first as they are, and second, as they appear when changed by transmitted or reflected colored light.

The experiments upon which Field's theory was founded were made by passing light through glass wedges filled with colored liquids. Thus through two wedges placed together and filled, one with blue, and the other with yellow, light of a green color was obtained, but, as explained on p. 20, blue and yellow light combine to form white light. The green light which passes through the two wedges is simply the light which is not absorbed by them. The wedges transmit green light, but stop almost all the other rays, and the result is not the mixing of light at all, but is identical in nature and effect with the mixing of the pigments blue and yellow.

The pigment theory of color is most interestingly illustrated by a new process of color printing, in which three photographs of the subject are made through colored glasses; one through a red glass, the second through a yellow, and the third through a blue glass. These colored glasses shut off all the rays except those of the one color which they transmit, hence each negative will print only the parts which are acted upon by one set of rays. From these negatives three plates are made, which are printed one after the other of their respective colors, red, yellow, and blue. The result produced is quite wonderful in its soft gradations and in its representation of all the colors of the subject.

CHAPTER IV.

CONTRAST.

CONTRAST is the effect produced upon one another by different colors, or by different tones of the same color.

All appearances are relative, and a color will appear light in contrast with a darker color, or dark in contrast with a lighter color. This is true not only of tones of the same scale of color, but of those of different scales of color.

When the colors are different, besides the change in the apparent amount of light and dark in the color, there appears a change in its nature, so that the same color may at different times appear of entirely different hues. Thus, if two squares of red paper of the same tone are placed upon larger squares of paper, one being green and the other a red of a different hue from the first, the smaller squares will appear very different, that upon the green paper seeming much purer and brighter than that upon the red.

The effects of contrast are strongest nearest the lines in which the colors meet, and are best shown when a colored circle or square is placed upon a larger one of a different color. Thus, if we arrange circles of the spectrum colors as follows, the circles will seem much richer and stronger in color at the outside than near the centre, and the grounds will seem richer and darker near the circles:

A red circle upon a sheet of greenish blue paper,
An orange circle upon a sheet of cyan-blue paper,
A yellow circle upon a sheet of blue paper,
A green circle upon a sheet of violet paper,
A blue circle upon a sheet of yellow paper,
A violet circle upon a sheet of green paper.

Two rectangles of different colored papers, placed as is shown in Fig. 3, will appear graded, the dark one appearing darkest nearest

the light one, and the light one appearing lightest against the dark one.

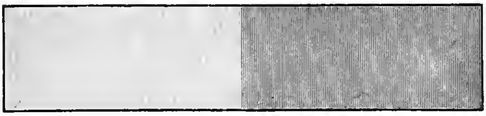


FIG. 3.

If the normal, tints, and shades of any color are arranged on one plane and in regular order from light to dark, each tone will appear graded as shown in Fig. 4. Any tone (as *A*) in contrast with a

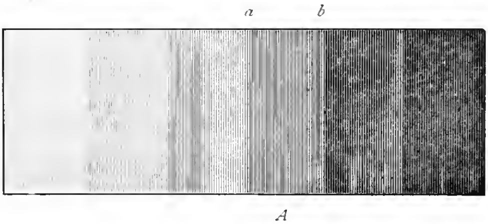


FIG. 4.

lighter one, appears darker at *a*, by means of the contrast with the light, and appears lighter at *b*, through its contrast with a darker tone. The effect of contrast makes it difficult to believe that the tones are really of uniform strength. The best way to make this experiment is by means of various tones of pure gray colored papers.

The contrast of different tones of the same color acts, principally, to produce the effect of light and shade. When the colors are different, there is, in addition to the light and shade effects, the action of the complementary color which is produced by each color and added to the other.

This complementary color, which causes contrasting colors to appear different from their real colors, is due to the fact that the color-seeing nerves become tired after they have acted for some time upon one color. If any bright object, as a red wafer, is looked at intently for a few minutes, the red-seeing nerves acted upon by the wafer become so fatigued that when the eyes are directed to some

other surface or color they are not sensitive to the red rays sent out by it; thus the tired red nerves cause the image of the wafer to be produced by the remaining rays, namely, the green and the violet. The surface, if white, will then seem to have a blue-green image of the wafer.

The strongest effect of this nature is produced by the setting sun, which, if looked at for a few minutes, causes the entire sky to be filled by bluish images of itself. These images are called negative, and are always of the color complementary to that causing them, when the surface upon which they appear is white; but if this surface is not white, the images are of a color which is the result of the combination of the complementary color with that of the surface on which they appear.

Most of the effects due to contrast of different colors may be explained in this way. If yellow and blue are placed in contrast, the eye glances from one to the other; when looking at the yellow, the blue-seeing nerves are resting, so that they are in condition to be acted upon most powerfully by the blue rays, when the eye turns from the yellow to the blue: in the same way the nerves are in the best condition to see yellow after the eye has been looking at the blue. Thus, complementary colors enhance or brighten each other by being in contrast.

If colors which are alike are placed in contrast, as two different reds, they will be mutually deadened by the green rays which each tends to add to the other.

The action which two colors in contrast exert upon each other is always to add to each other a small amount of the complementary of the other; thus colors enhance each other the greater their difference in hue, and deaden each other the nearer they are to the same color.

This action of colors upon one another is invariable and impossible to avoid. To see the finer effects produced by it requires a good color sense, trained by long years of study; the more powerful effects all can see.

These effects are the most powerful when the colors are of equal intensity. If colors which are unequal in intensity be contrasted, the one most saturated will gain in strength, while the pale color

will appear paler, and may even be made to change its color to some other hue by the addition of enough of the complementary of the strong color to more than neutralize the weak. Thus a pale red in contrast with a strong purple will be so affected by the green complement of purple as to appear quite white, and it may even appear green instead of red.

The effect of the contrast of pale with strong colors will be to weaken or change the hue of the lighter color, and to strengthen the darker, except when the colors are complementary, in which case both will be increased in intensity.

The effects of contrast are variable with the intensity of the light, as different colors change their relations when carried from a strong to a feeble light. Thus of a red and a blue which appear of equal brightness in a common studio light, the red will appear much the brighter if the colors are exposed to direct sunlight, while if carried to a darkened room the blue will seem the brighter. This explains the fact that artists so often find the sketches, which seemed warm and luminous when they were being worked upon out-of-doors, very cold when seen in the weaker light of the studio.

The effects of contrast are much stronger under a strong light than under a weak one; hence it follows that, if a picture is to give in the feeble light of a room the effects of strong sunlight contrasts, the actual colors seen must often be changed in the painting, so that in the weak indoor light the contrast effects may be nearer the strength that they were in the strong outdoor illumination. As the light diminishes, the color red is the first to appear darker; then follow orange, yellow, green, blue, and violet, in their order; and it is evident that strongly colored pictures in a light key cannot, if they were painted in a strong light, be made to look well in a dark room.

The effects of contrast are frequently much stronger with light colors than with intense or saturated colors, for the strong positive colors often act so powerfully upon the eye as to render the contrast effects difficult to see; while with delicate colors the action of the original color on the eye is readily changed by contrast. This may be shown by the following experiments of H. Mayer.—Place a small strip of gray paper on a sheet of green paper, and it will not be easy to see a change in the color of the gray paper. But if the papers

are covered by a thin sheet of translucent white tissue paper, which greatly weakens the colors, the gray paper will at once appear of a red tint.

These facts explain the power and strength which the best pictures of the impressionist school possess. Though the shadows of these pictures are often not so dark as the lights of pictures of older schools, they are so much more effective that one of them in a gallery of the older pictures will cause all of the latter to appear dark and almost colorless.

The effects produced by the same colors under gas or lamplight and under sunlight are very different. Some colors are changed much more than others, and some pigments more than other pigments of the same color. I remember a picture which appears gray by daylight, but a strong violet by artificial light. It is not at all satisfactory as the representative of its subject, — an overcast day.

Colors when contrasted with white, black, or gray are changed to a slight extent. The change is mainly due to apparent increase or decrease of luminosity in the colors, resulting from their contrast with a lighter or darker value. Thus light colors appear brightest when contrasted with black. The dark colors appear strongest when contrasted with white.

The various contrast effects which have been described have been classified by Chevreul as simultaneous, successive, and mixed.

Simultaneous contrasts result from the action of different colors which are seen at the same time, and affect the hues of the colors and the depth of their tones.

Successive contrasts result from the long-continued action of any color upon the eyes. This action causes the eyes to see, when they are turned away from the object, its image tinged with a color which is complementary to that of the object.

Mixed contrasts are produced when an object or color is seen by eyes which retain the image of any object previously seen tinged with its complementary color, the color of the second object being changed by this complementary image of the object first seen.

CHAPTER V.

HARMONY.

HARMONY in color is difficult to obtain, and more difficult to describe or reduce to law. Different authors give varying definitions of the different types of arrangements in which it may exist.

Chevreul arranges the different harmonies of colors in two classes, as follows:

"FIRST SPECIES: HARMONIES OF ANALOGY. — 1. *The harmony of scale*, produced by the simultaneous view of different tones of the same scale, more or less approximating. 2. *The harmony of hues*, produced by the simultaneous view of tones of the same, or nearly of the same depth, belonging to neighboring scales. 3. *The harmony of a dominant colored light*, produced by the simultaneous view of various colors assorted according to the law of contrast, but one of them predominating, as would result from the view of these colors through a slightly-colored glass.

"SECOND SPECIES: HARMONIES OF CONTRAST. — 1. *The harmony of contrast of scale*, produced by the simultaneous view of two very distant tones of the same scale. 2. *The harmony of contrast of hues*, produced by the simultaneous view of tones of different depths, belonging to neighboring scales. 3. *The harmony of contrast of colors*, produced by the simultaneous view of colors belonging to very distant scales, assorted according to the law of contrast. The difference in the depth of the adjacent tones may further augment the contrast of colors."

Ruskin gives the following definitions.

HARMONY OF CONTRAST. — Two very distant tones of same scale of hues. Tones of different depths belonging to neighboring scales.

HARMONY OF ANALOGY OF SCALE. — Different tones of same scale more or less approximate.

Harmony of Analogy of Hues. — Tones of the same, or nearly the same, depth of neighboring scales.

Harmony of a Dominant Colored Light. — Various colors assorted after the law of contrasts, but one of them predominating, as if viewed with a colored light or through a colored glass.

Mr. Henry T. Bailey, state supervisor of drawing in Massachusetts, has classified and defined the typical harmonies of color as follows:

1. Contrasted Harmonies.

Those in which color is contrasted with non-color; or, more accurately, in which a passive color (white, gray, black, silver, or gold) is contrasted with an active color, a tone from the spectrum chart.

2. Dominant Harmonies.

Those in which are combined different tones in one color scale.

3. Complementary Harmonies.

Those in which are combined opposite tones of complementary colors.

4. Analogous Harmonies.

Those in which are combined tones from analogous scales.

5. Perfected Harmonies.

A. Those in which analogous colors are combined with the complementary of the key color. *B.* Those in which the effect of one analogous harmony is complementary to the effect of another.

It is unnecessary to teach these terms in the public schools; therefore the lack of harmony between the different definitions is of slight consequence.

According to Field, the primaries — yellow, red, and blue — combine in the surface proportions of 3, 5, and 8 respectively and produce white light; and he holds that the colors of a design should be combined in the above proportions in order to be satisfactory. Thus 3 parts of yellow and 5 of red give 8 of orange, which harmonize with 8 of blue; or 5 of red and 8 of blue form 13 of violet, which

harmonize with 3 of yellow; or 8 of blue and 3 of yellow give 11 of green, which harmonize with 5 of red, or

19 of citrine harmonize with	. . .	13 of violet.
21 of russet " "	. . .	11 of green.
24 of olive " "	. . .	8 of orange.

The three secondaries together, or the three tertiaries together form perfect harmony, as do the three primaries.

Citrine, which inclines to yellow, harmonizes with violet, as does yellow.

Russet inclines to red and harmonizes with green, as does red.

Olive inclines to blue and harmonizes with orange, as does blue.

In the case of the tertiaries, the loss of brilliancy is made up by the increase of surface covered: thus 19 of citrine or 13 of violet harmonize with 3 of yellow.

Owen Jones is considered one of the best authorities upon ornament. From his "Grammar of Ornament" the following propositions relating to color are taken:

"Color is used to assist in the development of form, and to distinguish objects or parts of objects, one from another."

"Color is used to assist light and shade, helping the undulations of form by the proper distribution of the several colors."

"These objects are best attained by the use of the primary colors on small surfaces and in small quantities, balanced and supported by the secondary and tertiary colors on the larger masses."

"The primary colors should be used on the upper portions of objects, the secondary and tertiary on the lower."

"When a primary tinged with another primary is contrasted with a secondary, the secondary must have a hue of the third primary."

"In using the primary colors on moulded surfaces, we should place blue, which retires, on the concave surfaces; yellow, which advances, on the convex; and red, the intermediate color, on the under sides, separating the colors by white on the vertical planes."

"The various colors should be so blended that the objects colored, when viewed at a distance, should present a neutralized bloom."

"No composition can ever be perfect in which any one of the three primary colors is wanting, either in its natural state or in combination."

"When two tones of the same color are juxtaposed, the light color will appear lighter, and the dark color darker."

"When two different colors are juxtaposed, they receive a double modification; first, as to their tone (the light color appearing lighter, and the dark color appearing darker); secondly, as to their hue, each will become tinged with the complementary color of the other."

"Colors on white grounds appear darker; on black grounds lighter."

"Black grounds suffer when opposed to colors which give a luminous complementary."

"Colors should never be allowed to impinge upon each other."

"When ornaments in a color are on a ground of a contrasting color, the ornaments should be separated from the ground by an edging of lighter color; as a red flower on a green ground should have an edging of lighter red."

"When ornaments in a color are on a gold ground, the ornaments should be separated from the ground by an edging of a darker color."

"Gold ornaments on any colored ground should be outlined with black."

"Ornaments of any color may be separated from grounds of any other color by edgings of white, gold, or black."

"Ornaments in any color, or in gold, may be used on white or black grounds, without outline or edging."

"In 'self-tints,' tones, or shades of the same color, a light tint on a dark ground may be used without outline; but a dark ornament on a light ground requires to be outlined with a still darker tone."

The propositions of Owen Jones relating to color harmony repeat the theories of Field. These theories are entirely false, and any propositions based upon them must be rejected as imperfect, and will be useful only as they may assist in producing results which do not violate the best taste.

The colors which are complementary are often said to be the best for combinations. If so, there is instantly contradiction between the pigment theory of color and the light theory. By the pigment theory blue and orange combine to produce white light, but by the light theory blue and yellow produce white. Red and green are complementary by the pigment theory, and red and blue-green, by the light theory.

Combinations of complementary colors, though satisfactory by either theory or by both, are often crude and unsatisfactory in practice, and we find that for many purposes the best designers make use of colors which are very closely related, or of tints or shades of colors which are complementary. Upon this point Rood gives the following paragraph:

"The complementary colors are very valuable when the artist is obliged to work with dark, dull, or pale colors, and still is desirous of obtaining a strong or brilliant effect. The fact that the colors are dull, or pale, or grayish, prevents much possibility of harshness ; and the use of complementary hues excludes all risk of the brilliancy of the tints being damaged by harmful contrast. In general, the lower we go in the scale, and the more our colors approximate to black, brown, or gray, the more freely can we employ complementary hues without producing harshness ; and even the objectionable pairs, red and green-blue, purple and green, if sufficiently darkened become agreeable."

When colors very closely related are used in a design, the effect produced is not that of different colors but of the same color, and, in practice, combinations of colors which are closely related are very satisfactory.

The statement that the best arrangements are those in which colors are combined in such proportions as to produce white by the light theory, or black by the mixing of pigments, is not supported by the best art work, where the effect produced is that of some one color, and not, as Owen Jones states, "a neutralized bloom."

To produce a work of art in color we must work from within, and no study of rules will take the place of sentiment. Study of the opinions of others will assist us to form opinions of our own ; and the experience of those who have produced good art work will, if noted

and observed by those less skilled, enable them to avoid the most glaring faults. Study of such books as those by Chevreul and von Bezold will therefore be valuable. The best instruction in this line will be gained, not from books, but from the works of the best masters in both fine and industrial arts. Study of the best tapestries, draperies, and decorations will do more to cultivate good taste concerning color than any books that have been or may be printed; but those who wish text upon this subject will find it without trouble.

A few years ago the popular idea concerning art work was that good art was carried out in dull colors. In fine art it was stated, for instance, that bright colors were the sure indications of inferior art. The day of such a statement has passed, yet it is as true in a sense now as then. Particularly in decorative work should the effect produced be quiet and unobtrusive. It has been found possible to combine light and bright colors in such a way that they act upon one another by contrast to produce a rich general tone or bloom. This can be done in decorative as well as in pictorial work, and the only point to be insisted upon, whether the scheme of color is low or high in tone, is that the colors be so combined that they do not produce a crude, spotty, and cut-up effect.

It is not possible to specify more than this, for the effect depends upon the position and the distance at which the colors are seen. As a general thing in public school work, the designs being for objects seen near at hand, it will not do to combine the primaries, for the colors cannot be sufficiently divided to neutralize each other. The secondaries and tertiaries, with their tints and shades, can be used to much better advantage.

A point of great importance is simplicity. This will be better given by few colors than by many, and the larger the masses of flat color, the fewer should be the colors used. Two or three tones of a color will combine pleasantly, also contrasting tones of the secondaries or tertiaries; the primaries, when used, should be reserved for the small bits which serve as accents.

PART II.

COLOR IN THE PUBLIC SCHOOLS.

By AMY SWAIN.

Every child has an inborn love of color, although not always of beautiful color. It is our privilege as teachers to cultivate that love; to lead them to see and appreciate the beautiful colors and harmonies of color found in Nature and art; and to assist them to apply the knowledge gained, in simple combinations of color and form for decorative purposes. Thus the practical as well as the æsthetic nature of the child is developed.

The materials for color study are expensive, and some may wish to omit the work which requires colored paper and pigments.

The exercises suggested in this course combine the study of color and arrangement (design). Those who wish to omit the color may do so, and make the work the study of design simply, by using plain paper for all the exercises in cutting, folding, and pasting; and instead of colored designs in paper or pigments, the units may be used as patterns to give designs in pencil outline.

In the upper grades, in place of the color work, lessons in design, free-hand drawing, or in working drawings may be given. The manuals on the different subjects are arranged so that teachers may carry any subject much farther than the work suggested for the course, and thus perfect freedom is given for any changes desired or necessary on account of expense.

MATERIALS

For Color Study and Work with Colored Papers.

1. Glass prism.
2. Colored tablets representing the six leading colors of the solar spectrum, and also six intermediate hues.

3. Colored papers for use in arrangements.
4. Gray mounting paper.
5. Practice paper, from which to cut patterns.
6. Mucilage.
7. Scissors for each pupil.
8. A large envelope for each pupil, in which to keep materials and designs.

For Work with Pigments. Materials for Each Pupil.

1. One round camel's-hair brush, about $\frac{1}{4}''$ in diameter.
2. One pan each of red, yellow, blue, and black pigments.
3. One small sponge, or piece of soft white cloth.
4. One piece of blotting paper.
5. One cup, or receptacle for water.
6. Two small butter-dishes, or equivalents, for the washes.
7. One block of paper.

SUGGESTIONS TO TEACHERS.

RECOGNITION OF COLOR.

A first exercise should be to investigate the ability of the children to distinguish colors.

Distribute the boxes containing the colored tablets and hold a piece of colored paper so that all can see it. Ask the children to find all the tablets of that color which are in their boxes, and to place them together on their desks. Have each child remove all the tablets from his box and place them on his desk ; and then place in separate piles all those of the same color.

CHOICE OF COLORS.

Ask each child to select a tablet of the color liked best and place it at the back of the desk, or, better still, under the box, so that other children may not see the color chosen. Ask for reasons of preference of colors. Then have each child find all the tablets he can of the color which he likes best, and place them in a pile at the back of the desk. This will show which colors are the most attractive to the children.

A record of this exercise should be kept, and other exercises of this nature given, in order that comparison of these records may be made.

Such records will show in time what changes in the color sense may have occurred.

THE SOLAR SPECTRUM AND COLOR SCALE.

The solar spectrum is an oblong image formed by a beam of light transmitted through a triangular glass prism and falling upon a sheet of white paper. The light is separated by the prism into its primary colors. Other examples of the solar spectrum are seen in the rainbow and upon soap bubbles.

The solar spectrum forms the basis for color investigation and study. From it a scale is formed by selecting the six leading colors

and six intermediate colors. The six leading colors are red (*R.*), orange (*O.*), yellow (*Y.*), green (*G.*), blue (*B.*), and violet (*V.*). The intermediate colors are red-orange (*R.–O.*), orange-yellow (*O.–Y.*), yellow-green (*Y.–G.*), green-blue (*G.–B.*), blue-violet (*B.–V.*), and violet-red (*V.–R.*). These colors occupy unequal spaces in the spectrum; but for color study in the lower grades of the public schools, the pieces of colored paper which are used to represent the spectrum are of the same width.

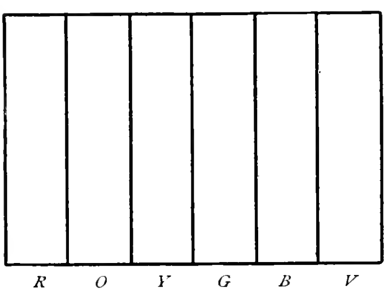
More than one color between any two successive leading colors may be used to form the scale for color study; but for public school work more than twelve colors, with their tints and shades, will be confusing.

The light passing through a glass prism and falling upon a white screen gives the strongest example of the solar spectrum, and is therefore the best for use in the school-room.

Each building should be provided with a triangular glass prism. The pendants from a chandelier may be substituted, but are not as satisfactory.

Place the prism in the sunlight so that the spectrum is formed where all the children can see it. The interest exhibited in the beautiful color is intense. Some children will say it looks like the rainbow, while others may think of the colors they have seen in soap-bubbles.

Have each child go to the spectrum and find as many colors as possible. At first, most of the very young children will find but four; but, after repeated exercises, they will distinguish six distinct colors. Let them select the colored tablets which are like the colors of the spectrum.



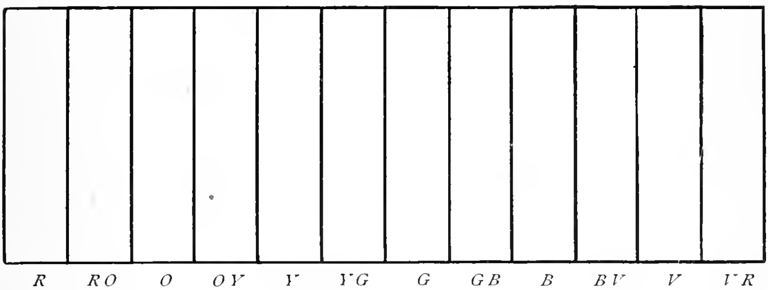
Have them lay the colored tablets to represent the six colors discovered, in the order in which they appear in the spectrum. Repeat this exercise until the children are familiar with the six leading colors, and can lay them in their correct order.

COLOR RELATIONS.

After the children have become familiar with the six leading colors, red, orange, yellow, green, blue, and violet, and the order in which they appear in the spectrum, give a few exercises on the relation of colors.

To make a lesson of this kind interesting ask if any of the children have little brothers or sisters, and how one would know that Carrie was Mary's sister, if they were standing side by side. They will say at once that Carrie looks like Mary. Then tell them that all the colored cards which they have in their boxes have brothers or sisters, too. Hold up a red card so that all can see it, and without giving its name, ask how they may know which colored tablets are related to the one selected.

They will say that the ones which look like it will be related. Have



each child select a tablet like the teacher's, and place it on his desk. Then ask the pupils to find other tablets which look like the ones which they have selected. Usually every pupil will find one, and often two, tablets which are related to the one which he has. Repeat the exercise, using a different color each time, and then have the children try to lay the spectrum chart by relation of colors. After a little practice they will lay the twelve colors in their correct relationship.

INDIVIDUAL COLOR AND COLOR NAMES.

To present any color, the teacher must be provided with a piece of paper, of the color to be taught, at least 4″ square. The children must have boxes of colored tablets.

Hold the piece of paper so that all the children can see it, and then ask them to find tablets of the same color. If any have not found the correct color, pass along the aisles, with the large piece of colored paper, and give each child a chance to compare the color which he has selected with the color desired. Do not tell them if they have not the right color, but let them discover and correct their own mistakes. After they have found the correct color, have each child place all the tablets of that color together in a pile on his desk; then ask them to find all examples of this color which are in the room.

The color name may now be given. Such questions should be asked as will call forth a repetition of the name of the color taught.

Have the children think of all the examples of the colors studied that are to be found in Nature and natural objects. Encourage them in bringing bits of worsted, cloth, ribbon, etc., representing the standard colors as they are studied.

The colors are to be taught in the order in which they appear in the solar spectrum.

To add interest to the exercises, and that the impressions of the colors may be more thoroughly fixed in the minds of the children, memory gems, including color thoughts, may be given in connection with the color lessons.

TINTS AND SHADES.

Teach the tints and shades of any color by comparing them with the normal tone of that color. Large pieces of colored paper are required, as in the lessons on the normal colors.

First, review the normal of the tints to be taught, and then compare the tints with this. The children will readily say that they are lighter than the normal, one being lighter than the other. Define *tint*, and give names *light* and *lighter*. Have the pupils arrange the normal and two tints of any color in a graded scale. Teach the shades in the same manner as the tints were taught, giving names *dark* and *darker*. Have the pupils arrange five tones of any color in a graded scale, beginning with the lightest tint or the darkest shade.

LIGHTER
LIGHT
NORMAL

Ask the children to discover all the illustrations of the colors in the room, and to bring in examples of different tones of the same color.

The tints and shades may be taught and illustrated by the use of pigments. If water colors are used, tints may be made by adding water, and shades may be made by adding black to the full tones of the pigments. Washes of these different tones may be placed on paper before the class. In oils, tints are formed by adding white, and shades are formed by adding black, to the normal tones. Tints and shades may also be taught by the use of the color wheel.

LIGHTER
LIGHT
NORMAL
DARK
DARKER

Lead children to observe the beautiful colors in Nature and natural objects. Let them look from the windows and describe the colors seen.

ARRANGEMENTS OF COLORED PAPER.

In the lower grades, the arrangements to be executed in colored papers are first made with the small tablets. Thus the number of units required is ascertained. In later work the geometric forms are varied; and radial, border, and surface arrangements are made with units suggested by face views of flowers and leaves.

For the most advanced work, elementary and applied designs may be made, with units suggested by plant forms and historic ornament.

At first, make the arrangements of one tone of colored paper and mount them on a neutral gray background.

NOTE. — For busy work, the children may be allowed to make original arrangements, using the bits of colored paper which are left from the regular color lessons, and combining them as their tastes dictate.

Later combine two or more self-tones. Four or even five tones of a color may be effectively combined. One tone may be used to outline the units by cutting from a second tone a second set of units a little larger than the first and mounting the smaller ones on the

larger, and these on the background. The background may be made by cutting backgrounds of different sizes from the different tones and mounting the smaller on the larger. Adjacent tones must be carefully selected, as violent contrasts are generally unpleasant.

Combining these self-tones leads the child to make harmonious combinations, when, in later work with the colored papers, he is allowed to combine such colors as his taste dictates.

To obtain the colored units, trace around the tablets or patterns on colored paper and cut. The tracings or drawings should be placed as closely together as possible, to avoid unnecessary waste of material. The tracings must always be made on the white side of the paper, that the pencil lines may not show when the design is completed.

After the units are cut, they may be arranged and pasted on the background. With young children it is well to place points for the positions of the units.

The best results in pasting are obtained by using a very thick mucilage, made by dissolving a cheap grade of gum arabic or gum tragacanth in *cold* water. *Very little* of this is needed to hold the units securely in position. A piece of paper with a drop of mucilage upon it is all that is required for each pupil. Apply the mucilage at the centres with a tooth-pick if the units are small, and near the points if the units are large.

After the units are in position, place a piece of clean paper over them and rub quite hard with the flat surface of the thumb or finger-nail, or with the tips of the fingers. This presses the units down perfectly flat. The design may then be placed under pressure until dry.

PAPER FOLDING AND CUTTING.

To have well-balanced units and arrangements in color work, it is necessary to have patterns which are as nearly perfect as possible. The best patterns are made by folding and cutting. In making designs of varied geometric forms, the units should not be folded and cut directly from the *colored* paper, as creases are not desirable. Therefore, the children must be able to fold and cut accurately from

practice paper variations of any geometric form, and also patterns for balanced units or designs. Pupils will find this knowledge beneficial in advanced as well as elementary work.

An illustrated talk on this subject should be given by the teacher. After such a talk, many interesting and original variations of the geometric forms may be made at home by the children.

The following are the steps by which any geometric form may be varied:

1. Cut the form to be varied.

This may be done in several ways. In the lower grades, the forms are obtained by tracing around the large tablets and then cutting. If forms larger than these are required, as is often the case in higher grade work, the forms are constructed by geometric methods.

2. Fold to form the number of units required.

It will be observed by the following illustrations that when it is desired to repeat one unit about a centre, the form to be varied is folded so that a crease passes through the centre of each unit, and also half way between each two units. The folds and edges must represent to the pupil the different parts of the form to be varied. See varied square, Fig. 4.

3. Draw half a unit in the position desired.

If the unit is to be repeated on a diagonal, it must be drawn so that its axis is the fold which represents a diagonal of the form to be varied. If the unit is to be repeated on a diameter, it must be drawn so that its axis is the fold which represents a diameter of the form to be varied.

4. Cut on the lines drawn.

5. Unfold.

The above notes give the method of procedure when it is desired to vary the forms in such a way that they represent rosettes or a repetition or alternation of units about a centre. The same method, however, is employed when a simple variation of a geometric form is required, except that it is not always necessary to draw the variation before cutting. In order to keep the units from being too complicated, it is often advisable to limit the children as to the number of cuts they may make.

The following figures illustrate the steps described above, and also show that it is desirable to keep the forms simple. Study face views of flowers and also leaves which are simple in outline, for suggestions of units.

The Square.

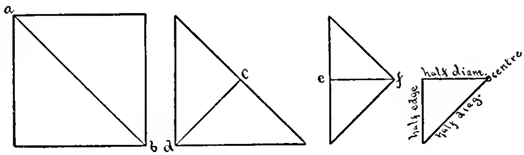


Fig. 1. Fig. 2. Fig. 3. Fig. 4.

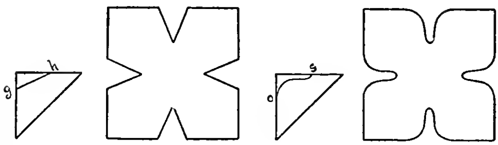


Fig. 5. Fig. 6. Fig. 7. Fig. 8.

1. Cut a square, Fig. 1.
2. Fold Fig. 1 on *ab* and obtain Fig. 2.
3. Fold Fig. 2 on *cd* and obtain Fig. 3.
4. Fold Fig. 3 on *ef* and obtain Fig. 4.
5. Draw line *gh*, Fig. 5, or any simple variation as *os*, Fig. 7, and cut.
6. Unfold and obtain the pattern, Fig. 6 or Fig. 8.

The Equilateral Triangle.

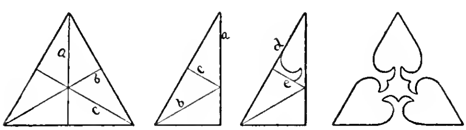


Fig. 1. Fig. 2. Fig. 3. Fig. 4.

1. Cut the triangle Fig. 1.
2. Fold on line *a* Fig. 1.
3. Unfold and fold on line *b*.
4. Unfold and fold on line *c*. Unfold.
5. Fold Fig. 1 on line *a* and obtain Fig. 2.
6. Draw line *de*, Fig. 3, and cut.
7. Transfer this unit to the other corners to obtain the desired units.
8. Cut on the lines drawn and obtain Fig. 4.

The equilateral triangle can be folded so that all the units may be cut at one time, but the method explained insures more accurate results, and is applicable to the variation of other forms.

THE PENTAGON.

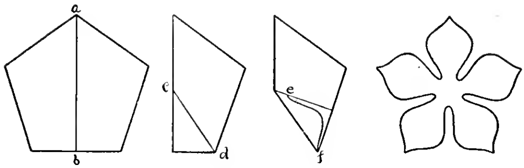


FIG. 1. FIG. 2. FIG. 3. FIG. 4.

1. Cut the pentagon, Fig. 1.
2. Fold Fig. 1 on line *ab*, and obtain Fig. 2.
3. Fold Fig. 2 on *cd*, and obtain Fig. 3.
4. Draw line *ef*, Fig. 3, and cut.
5. Transfer this unit to the other corners to obtain the desired units.
6. Cut on the lines drawn, and obtain Fig. 4.

THE HEXAGON.

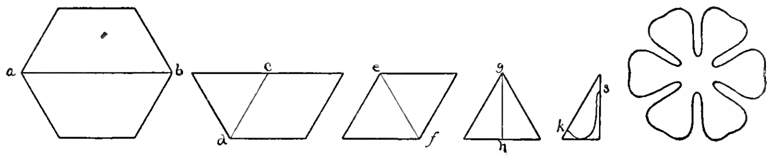


FIG. 1. FIG. 2. FIG. 3. FIG. 4. FIG. 5. FIG. 6.

1. Cut the hexagon, Fig. 1.
2. Fold Fig. 1 on line *ab*, and obtain Fig. 2.
3. Fold Fig. 2 on line *cd*, and obtain Fig. 3.
4. Fold Fig. 3 on line *ef*, and obtain Fig. 4.
5. Fold Fig. 4 on line *gh*, and obtain Fig. 5.
6. Draw the line *ks*, Fig. 5, and cut.
7. Unfold, and obtain Fig. 6.

If it is desired to make a pattern for a rosette with three, five, or six points, polygons of the required number of sides may be con-

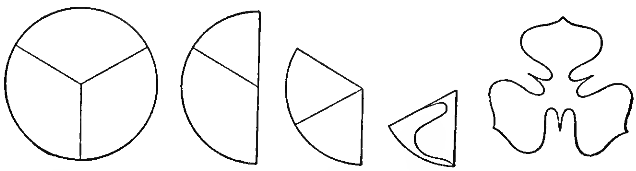
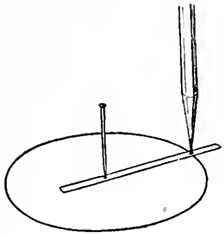


FIG. 1. FIG. 2. FIG. 3. FIG. 4. FIG. 5.

structed, and then folded and cut. A simpler way, however, is to

describe a circle of the required size, and divide the circumference into a number of parts equal to the number of points in the rosette.



From these points to the centre of the circle draw lines with the ruler. Cut the circle and fold on the lines drawn. Fold again, draw half unit, and cut. When unfolded, it will be the required pattern. See illustrations.

NOTE. — To draw circles of any required diameter when compasses are not provided, take a strip of cardboard and make two pinholes near one edge, the distance apart of the radius of the required circle. Then put a lead pencil through one hole, and revolve about a pin, which is placed in the other. This gives the required circle.

TRACING PAPER.

Instead of cutting patterns, designs may be duplicated by the use of tracing paper, as follows: Place the tracing paper over the design to be transferred, and hold it in place by the use of tacks, a weight, the hand, or by a little mucilage, while the design is traced to the paper with a hard pencil. Then turn the paper over, and with a softer pencil go over the lines of the tracing as seen from the back of the paper. Place the tracing paper in position, with the soft pencil lines against the paper to which the drawing is to be transferred. Transfer by drawing over the lines with the hard pencil. The tracing may be used to give as many transfers as desired.

This method of transferring is especially useful in color and design work for the upper grades, where the designs are too complicated to cut the patterns, or where it is desired to make one half of a design exactly like the other half.

The same method is employed in transferring designs to the color block, for work with pigments.

PIGMENTS.

Moist water colors are the most convenient for use in the schoolroom. In the first work with pigments, color is the only essential, hence all enclosing forms may be drawn in the quickest way, which is

by the use of a ruler, compasses, tracing paper, or by drawing around tablets or patterns.

Before any attempt to handle pigments is made by the pupils, an illustrated exercise should be given by the teacher, to show the method of using materials.

If a flat wash of any color is required, first draw the form to enclose the wash; then moisten the paper with a damp sponge or cloth to cause the paper to absorb the color readily and evenly. If this is not done the color will not fill the depressions in the paper, and will dry, leaving white spots.

For the normal tones the pigments are to be taken from the pans with the brush, thoroughly mixed with water, and applied to a piece of white paper, kept for the purpose of testing the washes. If the wash proves too light, more pigment should be added, until a wash of the required strength has been produced, the normal colored paper serving as a standard for comparison.

The washes must give, when first applied, a color stronger than is desired, as they lighten in drying.

When the paper, which has been moistened, is nearly dry, place the block upon the desk. It is then slightly inclined, so that the water will flow downward. Fill the brush with the prepared wash and apply to the paper. Beginning at the upper left portion of the figure, carry the brush regularly across from left to right and from right to left, and at the same time move it gradually downward. The brush should be kept well filled with color, and its side should be upon the paper.

The point of the brush is used for corners or for places where it is necessary to use but little color. The brush should be kept well charged with color until the space is nearly covered, when the color not required may be removed by the use of a dry brush. The brush may be dried by the use of a blotter or sponge, or by pressing it against the side of the water glass.

If by accident the color runs over the edges, the irregularity may be remedied by placing the blotter flat upon the block, outside of the form of color and against the edge. This will remove the surplus color without injury to the drawing. The surface of the wash must not be touched, or an adjacent wash applied until the first is thoroughly dry.

In water colors, tints of any color are made by diluting the normal with water. Shades are made by the addition of black to the normal tone.

For a drawing representing a gradation from the lightest tint to the darkest shade of any color, begin at the top with the lightest tint, using the brush as described and working downward, gradually increasing the strength of the tone by adding pigment to the wash until, at the middle of the space, the full strength or normal tone is obtained. Then add a little black, and continue to add black as the wash proceeds until, at the bottom, the deepest shade is obtained.

Designs in Self-Tones.

When a border or surface decoration is to be colored, the outline must be drawn with a hard pencil.

The paper should be moistened, as explained, and then a wash of the lightest tone which is to be used may be placed over the whole drawing. Next, a wash, which will strengthen this to form the next darker tone required, may be placed over all the design except the lightest parts, that were completed with the first wash. Continue in this way until all the tones required are used, and the design is completed.

By carrying the lightest tone over the whole drawing, and the others as far as possible, hard water lines are not formed around the units. When washes are brought from two directions against any line, water lines and uneven results are generally produced.

When it is desired to copy a design in its actual colors, the colors must be tested on paper before being placed on the drawing.

COLOR APPEARANCES.

In the eighth grade the pupils may use the pigments to represent colors as they appear when influenced by distance, light and shade, etc. A simple preparation for the study of still life in color may be given by the use of a color-wheel. The discs may be arranged upon the wheel so that the pupils do not see them until they are in motion. They will, not knowing the colors of the discs, then have the best opportunity to determine their power to see color. The wheel used

for this purpose should be placed at the front of the room. When the pupils have laid the wash to represent the color, they may compare their work with that of others, and with the color produced by the wheel.

Another simple way in which transient color effects may be studied is by the use of a box arranged to hold a sheet of paper so that it may receive colored rays of light transmitted by a sheet of colored glass or gelatine. This box should be made so that the colored glass is not seen by the pupils, and they should not see the paper before it is placed in the box. The paper used in this box should be white or some light tint or color, for the colors produced by the use of dark colors will be so rich and dark that it will be impossible to represent them by pigments.

The colored glass or gelatine may be obtained in many different colors and tints, and the light transmitted may be varied by using two sheets at once.

Study of this kind will be interesting and valuable, and will lead to a higher appreciation of the beauties of Nature and art. Where the cost of materials necessary for color work does not prevent its being carried on, work can be obtained in the high schools which will show that color, as well as outline drawing, can be taught in the public schools.

The following tables from Rood's work on color give the effects produced by transmitted colored light falling upon different colors, and may assist those teachers who wish to use transmitted lights for color study:

TABLE I.

Yellow light falling on paper painted with

Carmine	gives . .	Red-orange.
Vermilion	" . .	Bright orange-red.
Orange	" . .	Bright orange-yellow.
Chrome-yellow	" . .	Bright yellow.
Gamboge	" . .	Bright yellow.
Yellowish-green	" . .	Yellow.
Green	" . .	Bright yellow-green.
Blue-green	" . .	Yellow-green (whitish).
Cyan-blue	" . .	Yellow-green.

Yellow light falling on paper painted with

Prussian-blue	gives	Bright green.
Ultramarine-blue	"	White.
Violet	"	Pale reddish tint.
Purple-violet	"	Orange (whitish).
Purple	"	Orange.
Black	"	Yellow.

Table II.

Red light falling on paper painted with

Carmine	gives	Red.
Vermilion	"	Bright red.
Orange	"	Red-orange and scarlet.
Chrome-yellow	"	Orange.
Gamboge	"	Orange.
Yellowish-green	"	Yellow and orange.
Green	"	Yellow and orange (whitish).
Blue-green	"	Nearly white.
Cyan-blue	"	Gray.
Prussian-blue	"	Red-purple or blue-violet.
Ultramarine-blue	"	Red-purple or blue-violet.
Violet	"	Red-purple.
Purple-violet	"	Red-purple.
Purple	"	Purple-red or red.
Black	"	Dark red.

Table III.

Green light falling on paper painted with

Carmine	gives	Dull yellow.
Vermilion	"	Dull yellow or greenish-yellow.
Orange	"	Yellow and greenish-yellow.
Chrome-yellow	"	Yellowish-green.
Gamboge	"	Yellowish-green.
Yellowish-green	"	Yellowish-green.
Green	"	Bright green.
Blue-green	"	Green.
Cyan-blue	"	Blue-green.
Prussian-blue	"	Blue-green, cyan-blue.

Green light falling on paper painted with

Ultramarine	gives	. .	Cyan-blue, blue.
Violet	"	. .	Cyan-blue, blue, violet-blue (all whitish).
Purple-violet	"	. .	Pale blue-green, pale blue.
Purple	"	. .	Greenish-gray, gray, reddish-gray.
Black	"	. .	Dark green.

Table IV.

Blue light falling on paper painted with

Carmine	gives	. .	Purple.
Vermilion	"	. .	Red-purple.
Orange	"	. .	Whitish-purple.
Chrome-yellow	"	. .	Yellowish-gray, greenish-gray.
Gamboge	"	. .	Yellowish-gray, greenish-gray.
Yellowish-green	"	. .	Blue-gray.
Green	"	. .	Blue-green, cyan-blue.
Blue-green	"	. .	Cyan-blue, blue.
Cyan-blue	"	. .	Blue.
Prussian-blue	"	. .	Blue.
Ultramarine-blue	"	. .	Blue.
Violet	"	. .	Ultramarine, violet-blue.
Purple-violet	"	. .	Blue-violet.
Purple	"	. .	Violet-blue, purple-violet.
Black	"	. .	Dark blue.

SYNOPSIS OF COLOR WORK

FOR AN EIGHT YEARS' COURSE.

First Year.

COLORS. Six leading normal colors: red, orange, yellow, green, blue, and violet.

Color perception.

Color relations.

Individual color and color names.

Use of colored papers in arrangements.

ARRANGEMENTS. Borders and rosettes of geometric forms, in one tone, mounted on gray paper.

Second Year.

COLORS. Six leading normal colors, with two tints and two shades of each.

Color names, tints, and shades.

Scaling of five tones of the same color.

Use of colored papers in arrangements.

ARRANGEMENTS. Borders and rosettes, of geometric forms and geometric forms varied, in two or three self-tones of colored paper.

Third Year.

COLORS. Six normal intermediate colors: red-orange, orange-yellow, yellow-green, green-blue. blue-violet, and violet-red.

Individual colors and color names.

Use of colored papers in arrangements.

ARRANGEMENTS. Units, borders and rosettes of geometric and varied geometric forms, in one tone of colored paper, mounted on gray backgrounds.

Fourth Year.

Colors. Six normal intermediate colors, with two tints and two shades of each.

Scaling of five tones of each intermediate color.

Use of colored papers in arrangements.

Arrangements. Borders and rosettes of geometric forms varied, and also of units based upon natural forms, such as leaves and face views of flowers. The arrangements are made of two or three self-tones of the intermediate colored papers.

Fifth Year.

Colors. Red-gray (russet), orange-gray (brown), yellow-gray (citrine), green-gray (olive), blue-gray (slate), violet-gray (heliotrope) ; normal, two tints, and two shades of each color.

Individual color and color names.

Scaling of five self-tones of the grays.

Use of self-tones of colored papers in arrangements.

Arrangements. Borders and rosettes of geometric forms varied, and units and arrangements suggested by plant forms and historic ornament, in two, three, or four self-tones of colored paper.

Sixth Year.

Colors. Red, yellow, and blue pigments. Six leading and six intermediate colors, normals, tints, and shades, in colored papers.

Uses of Colors.

Scaling self-tones in flat washes of the primary pigments.

Use of primary pigments in decoration.

Use of the intermediate colored papers in decoration.

Decoration. Border and surface designs, using units suggested by plant forms and historic ornament.

Seventh Year.

Colors. Red, yellow, blue, orange, green, and violet pigments.

Six leading colors, six intermediate colors, and the grays ; normals, tints, and shades in colored papers.

Uses of Colors.

Scaling self-tones of the secondary pigments in flat washes.

Use of secondary pigments in decoration.

Use of colored papers in decoration.

Decoration. Borders, rosettes, surface decorations, and elementary designs, the detail to be suggested by plant forms and historic ornament.

Eighth Year.

Colors. Pigments.

Uses of Colors.

Scaling self-tones of the tertiary pigments.

Experiments with pigments to represent apparent colors.

Use of pigments in decoration.

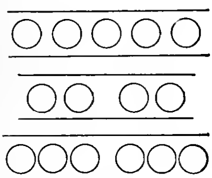
Decoration. Elementary and applied designs, the detail to be suggested by plant forms and historic ornament.

OUTLINE OF LESSONS.

The following lessons form the color work in the National Drawing Course ; they are to be given in the public schools as directed in the outlines of lessons for Primary and Grammar Grades.

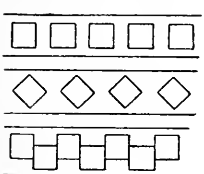
FIRST YEAR.

1. Test the color perception of the pupils. Each child choose the color he likes best, and place all of the tablets of that color in one pile. Reasons for preference of colors. Place all the tablets of the same color in separate piles.
2. Have the children discover all the colors they can in the solar spectrum, formed by the light passing through a glass prism and falling upon a sheet of white paper or upon a screen.
3. Lay as much of the spectrum chart as possible, by relation of colors. Have the spectrum before the class when possible.
4. Teach red. See "Individual Colors," page 41.
5. Review red, and see if the children can find the color which is next to red in the spectrum. Teach orange.



Suggestions.

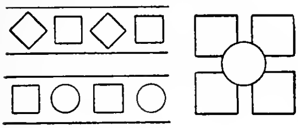
6. Make a border arrangement, using circular tablets. Teach unit. Teach repeat and repetition.
7. Part of the class use red, and the rest orange colored paper, and trace around the tablets to form the units of the border arrangement last made. Cut two narrow strips for border lines.
8. Cut the units traced, and place them in an envelope.
9. Arrange the units on a gray background, and begin to paste.
10. Complete the border arrangement.
11. Lay the spectrum chart by relation of colors.
12. Review red and orange and teach yellow.
13. Review colors studied and lay spectrum chart.
14. Review yellow and teach green.



Suggestions.

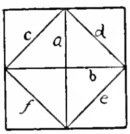
15. Make an original arrangement for a border, using square tablets.
16. Part of the class use yellow and the rest green colored paper, and trace around the square tablet to form the units of the border arranged.
17. Cut the units traced, and also two strips $\frac{1}{4}''$ wide, to be used as border lines. Place all in the envelope kept for color work.

18. Arrange the strips and units on a gray background, and begin to paste.
19. Complete the border arrangement.
20. Review colors studied, and lay spectrum chart by relation of colors.
21. Review colors studied and teach blue.
22. Review blue and teach violet.
23. Make an original radial or border arrangement, using square, or square and circular, tablets. Teach alternation of position and form.

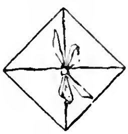


Suggestions.

24. Part of the class use blue and the rest violet colored paper. Trace around the tablets to form the units of the arrangement last made.
25. Cut the units traced, and place them in an envelope. If the arrangement is for a border, strips must be cut for border lines.



26. Arrange the units on a background of gray paper, and begin to paste.
27. Complete the arrangement.
28. Each child is to have a 6″ square of the color preferred. Fold on line *a*; unfold and fold on line *b*. Unfold and fold on lines *c*, *d*, *e*, and *f*. Fasten the corners together with ribbon matching the paper used. This forms a handkerchief case.



29. Trace around a $2\frac{1}{2}''$ square tablet on practice paper, and cut. Fold on its diagonals and diameters, and cut to vary the form. Unfold and keep the pattern. Time, twenty minutes.

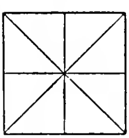


Fig. 1.

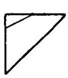


Fig. 2.

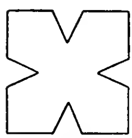
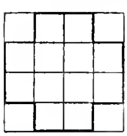
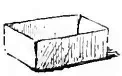


Fig. 3.

30. Each child use paper of some color studied, but one which he has not previously used in any arrangement. Trace around the pattern of the varied square, and cut.



31. Each child have a 4″ square of any colored paper preferred. Quadrisect the edges by folding. Cut on the folds shown by the heavy lines. By folding the outer portions, a box may be formed.



32. Using tablets of any of the forms studied, make an original border or radial arrangement. Have part of the children use one form and part another, and

others combine two forms, remembering the design and the number of units of each kind.

33. Let the first row of children use red colored paper, the second orange, the third yellow, and so on until all the colors studied are being used. Trace around the tablets to form the arrangement last made.
34. Cut the units traced, and when the designs are for borders, cut narrow strips of paper, the color of the units, for border lines.
35. Arrange the units on gray paper, and begin to paste.
36. Complete the arrangement begun, and review colors studied.

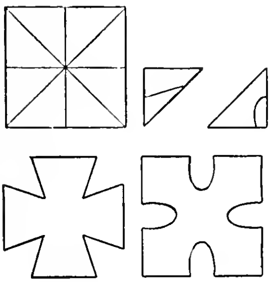
SECOND YEAR.

1. Review colors studied, and lay the spectrum chart by the use of colored tablets.
2. Review red, and teach tints of red.
3. Review red, and teach shades of red. Lay gradations of red.
4. Review orange, and teach tints of orange.
5. Review orange, and teach shades of orange. Lay gradations of orange.
6. Make an original arrangement of tablets for a border, combining any two forms studied.

   A great variety of borders may be obtained, the teachers designating the forms for the children to use. Thus, the first row may combine the square and circle, the second row the square and semicircle, and so on until all the forms studied have been given.
7. Each child use any two tones of red or orange colored paper which do not make too strong a contrast.

   Trace around the tablets on one tone to form the units of the border arrangement last made.
8. Cut the units traced. From a second tone of the same color cut an oblong for a background. Reserve.
9. Arrange the units on the background, and begin to paste.
10. Complete the border design, and review the colors studied.
11. Review yellow, and teach tints and shades of yellow. Lay gradations.
12. Review green, and teach tints and shades of green. Lay gradations.
13. Make an original radial arrangement of tablets, using any of the forms studied. Determine the size of the background required.
14. Each child use two or three tones of yellow or green colored paper. On one tone trace around the tablets to form the units of the radial arrangement last made.
15. Cut the units traced. Reserve.

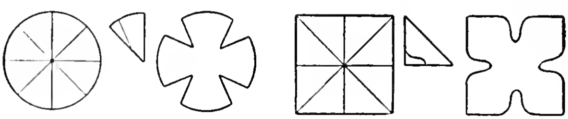
16. From a second tone of paper, the color of the units, cut a square background a little larger than the arrangement. From a third tone cut a square a little larger than the first.
17. Arrange the units on the smaller square, and paste. Then paste this on the larger square.
18. Review blue, and teach tints and shades of blue. Lay gradations of blue.
19. Review violet, and teach tints and shades of violet. Lay gradations of violet.



Suggestions.

20. Trace around a $2\frac{1}{2}''$ square tablet on practice paper, and cut. Fold on the diagonals and diameters. Vary the form as suggested, and keep the pattern.
21. All tones of blue and violet paper are to be used by the class, each child having any three self-tones. On one tone trace around the pattern last made. On a second tone draw a $3''$ square, and on a third a $3\frac{1}{2}''$ square for backgrounds.
22. Cut the units traced, and keep.
23. Paste the varied square on the smaller background, and then this on the larger background.
24. Trace around a $2\frac{1}{2}''$ circular or square tablet on practice paper, and cut. Fold three times, as illustrated, and vary.

Have the children make original variations. Keep the **pattern.**



25. Each child may use any two tones of the color preferred. On one tone trace around the pattern last made and cut.
26. From a second tone cut a square or circular background. Paste the design upon the background.

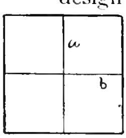
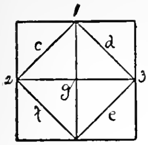


Fig. 1.

27. Making a Hanging Basket. Cut a $6''$ square from white paper, and fold on diameter *a*. Unfold, and fold on *b*. Fig. 1. Unfold, and fold on lines *c*, *d*, *e*, and *f*, Fig. 2.



NOTE. — Fold lines *a* and *b* from one side of the paper, and lines *c*, *d*, *e*, and *f* from the opposite side, so the laps will tip back when the basket is completed.

Cut from *1* to *2* and from *1* to *g*.

Fig. 2.

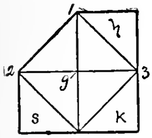


Fig. 3.

28. Each child is to have any tone of colored paper which he prefers. Trace around the small circular tablet twice, and around the small square tablet six times. Begin to cut the units.

29. Cut the units. Fold the circles on a diameter and cut. Fold three of the squares on a diagonal and cut.
    Time, twenty minutes.

Fig. 4.

30. }
31. } Arrange the units as illustrated (Fig. 4), on the triangles *h*, *k*, *s* (Fig. 3), which form overhanging portions of the basket. Place point 1 (Fig. 3) on point 2 and line 1–3 will coincide with line 1–2. Paste. The basket may be hung with ribbon matching the decoration.
    Time, two lesson periods.

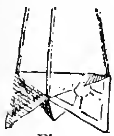
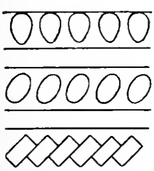


Fig. 5.

32. Make an original border or radial arrangement of tablets, using any one, two, or three of the forms studied.



Suggestions.

33. All the tones of all the colors studied this year are to be used in this exercise, each child having two or three self-tones. On one tone trace around the tablets to form the units of the arrangement last made.

34. Cut and reserve the units traced.

35. Cut the background for the border, or radial arrangement, of the desired size. A second background, $\frac{1}{4}''$ larger than the first, may be cut to place underneath the first. This gives the effect of border lines.

36. Arrange the units on the smaller background, and begin to paste.

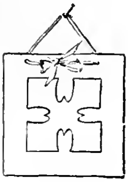
37. Complete the designs begun by pasting the smaller background on the larger one. Review colors studied.

THIRD YEAR.

1. Study the spectrum, and lay the spectrum chart by relation of colors.
2. Review the six leading colors, normals, tints, and shades.
3. Teach red-orange.
4. Teach orange-yellow.

5. Cut a 3″ square from practice paper. Fold on its diagonals and diameters. Each pupil make an original variation of the form, by drawing and cutting. Unfold and reserve the pattern.

6. Half the pupils are to use red-orange and the rest orange-yellow colored paper. Trace around the pattern of the varied square. Cut.



7. 8. Making a Shaving Case. Cut two 5″ squares from gray cardboard. On one of these paste the varied square cut the sixth lesson. This serves as the front of the case. The second gray square is the back. Between these cardboards place a generous supply of white tissue paper, which is cut 5″ square. Tie all together with ribbon to match the decoration.

9. Review colors studied, and teach yellow-green.

10. Teach green-blue. Lay spectrum chart by relation of colors.

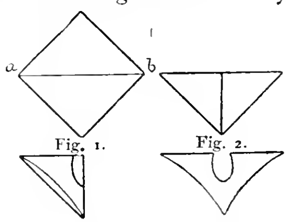


Fig. 1. Fig. 2. Fig. 3. Fig. 4.
Suggestions.

11. Trace around a $2\frac{1}{2}''$ square tablet on practice paper and cut. Fold on one diagonal, as *a b* (Fig. 1), and cut. Fold one of the triangles, as Fig. 2, and obtain Fig. 3. Each pupil make an original variation by drawing and cutting. Unfold and reserve the pattern.

12. Half the pupils are to use yellow-green and the rest green-blue colored paper. Trace around the pattern of the varied triangle four times. Also trace a 1″ square for centre.

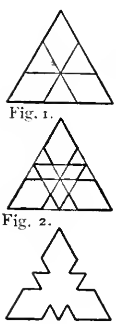


Fig. 1. Fig. 2. Fig. 3.

13. Cut and reserve the units traced.

14. Arrange the units on the diameters of a 4″ square gray background and paste. Paste the centre unit.

15. Review the colors studied, and teach blue-violet and violet-red.

16. Trace around a $2\frac{1}{2}''$ equilateral triangle on practice paper and cut. Trisect the sides, and connect the points of trisection by drawing as illustrated in Fig. 1. Bisect the sides, and connect the points as in Fig 2. Cut on the heavy lines and obtain the pattern Fig. 3, which is to be kept for future use.

17. Trace around the pattern of the varied triangle four times on blue-violet or violet-red paper. Cut an oblong background, of the required size, from gray paper.

18. } 19. } Cut the units traced and arrange on the gray background to form a border. Paste. (Two lesson periods.)

FOURTH YEAR.

1. Review red-orange and teach tints and shades of red-orange.
2. Review orange-yellow and teach tints and shades of orange-yellow.
3. Cut a $3\frac{1}{2}''$ square from practice paper and fold on diagonals and diameters. Each pupil make an original variation of the form by first drawing half a unit on a diagonal or diameter and then cutting. Unfold and reserve the pattern.
4. Each child may use any three tones of red-orange or orange-yellow paper. On one tone, trace around the pattern last made. On a second tone trace a $2\frac{1}{2}''$ circle or square.
5. Cut the units traced and also a $4''$ square from a third tone of the colored paper used.
6. Paste the design on the small circle or square and then these on the square background.
7. Review yellow-green and teach tints and shades of yellow-green.
8. Review green-blue and teach tints and shades of green-blue.

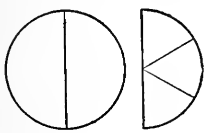


Fig. 1. Fig. 2.

Fig. 3. Fig. 4.

9. Draw a $3''$ circle by means of a strip of cardboard. Make two holes in the strip $1\frac{1}{2}''$ apart. Pass a pin through one hole and insert it in the practice paper, and passing the pencil point through the other hole, revolve it about the pin. Cut the circle and fold on one diameter. Trisect the half circumference and draw radii through these points. Fig. 2. Fold on one of these lines and draw a half unit on the part folded over, as illustrated by Fig. 3. Cut, forming two units. Use one of these as a pattern by which to cut the third unit. Keep the pattern Fig. 4 for future use. This circle may be varied as suggested, or each child may make an original variation.
10. All the tones of yellow-green and green-blue are to be used for this exercise, each child having any three self-tones. On one tone trace around the pattern last made. On a second tone trace a $2\frac{1}{2}''$ equilateral triangle, and on a third tone draw a $3\frac{1}{2}''$ circle.
11. Cut the units traced and keep for future use.
12. Paste the design on the triangle first and then these on the circular background. Review colors studied.

13., 14. Making a Needle Book. Draw two $3\frac{1}{2}''$ circles on gray cardboard and cut. On one of these, paste the design just completed. This is to form the front cover of the needle-book. The second card is for the back of the same. Between these two cardboards place two or three circles of the size of the cardboard covers, cut from white flannel. After these have been arranged, they may be fastened together near the edge with narrow ribbon, of any tone of the color used in the decoration. Two lesson periods.

15. Review blue-violet and teach tints and shades of blue-violet.
16. Review violet-red and teach tints and shades of violet-red.
17. Each pupil make an original radial design by varying any geometric form. First, draw on practice paper the form to be varied, having it $3''$ in diameter. Leaf forms and historic ornaments suggest pleasing units. Draw and cut. Reserve the pattern thus formed.
18. All tones of blue-violet and violet-red paper are to be used, each child having any two or three self-tones. On one tone, trace around the pattern last made, and draw a background a little larger than the design on a second tone. A second background may be drawn on a third tone if desired.
19. Cut the units traced and keep for future use.
20. Paste the design on the smaller background first, then this on the larger background. Review colors studied this year.

NOTE. — If desired the pattern may be traced three times and a border design constructed by repeating the unit. An oblong may be cut from a second tone of paper for the background of the border.

FIFTH YEAR.

1. Teach russet or red-gray, normal, tints, and shades.
2. Teach brown or orange-gray, normal, tints, and shades.

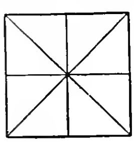


Fig. 1.

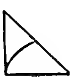


Fig. 2.

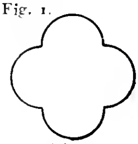


Fig. 3.

3. Cut a $4''$ square from practice paper, and fold on diagonals and diameters. See Fig. 1. Bisect a half diagonal, and from this point to the end of the diameter draw a quadrant, Fig. 2. Cut, and unfold to obtain the quatrefoil, Fig. 3. Trace around this pattern on one tone of russet or brown colored paper, and cut and keep for a background.

All tones of russet and brown are to be used.


Fig. 1.

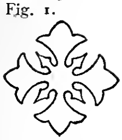
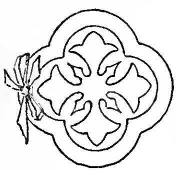


Fig. 2.

4. Fold the pattern of the quatrefoil and draw half a unit on the long edge, Fig. 1. Leave a space around the unit, as this is to be mounted upon the quatrefoil, and the design must not touch the outline of the background.
   Cut, and keep the pattern, Fig. 2.
5. On a second tone of russet or brown paper trace around the pattern last made. Cut, and mount on the quatrefoil of the same color previously cut.

6. }
7. } Making a Class-Book.

Cut two quatrefoils from gray cardboard, the same size or a little larger than the background of the design completed the 5th lesson. Paste the colored design upon one of the gray cardboards. This is for the front cover, while the second gray quatrefoil is for the back cover of a little book, in which it is very pleasant for the children to have the autographs of their classmates. Between the covers place quatrefoils of white paper. These should all be fastened together with ribbon to match the decoration.



8. Teach citrine or yellow-gray, normal, tints, and shades.
9. Teach olive or green-gray, normal, tints, and shades.
10. Trace around a $2\frac{1}{2}''$ circular tablet. Fold, and vary as suggested by the face view of some flower. Keep the pattern.
11. All the tones of citrine and olive are to be used by the class, each child having three or four self-tones. On one tone trace the rosette three times. Cut.
12. These rosettes are to form a border design. The manner in which they are to be mounted must now be decided, in order to draw the backgrounds. Let the pupils suggest ways of mounting.
    Draw and cut the backgrounds.
13. Arrange and paste the units to form the border designs.
14. Teach slate or blue-gray, normal, tints, and shades.
15. Teach heliotrope or violet-gray, normal, tints, and shades.
16. Teach neutral gray, normal, tints, and shades.
17. Select a border of historic ornament which can be cut from paper.
    Take a strip of paper $3''$ wide and not less than $9''$ or $10''$ in length. Draw half of one unit of the design at one end, and fold on the axis of the unit as many times as is required to make the desired number of units. Cut, unfold, and reserve the pattern.

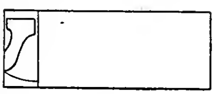


Fig. 1.


Fig. 2.

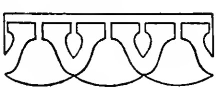
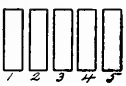


Fig. 3.

18. All the tones of slate, heliotrope, and neutral gray paper are to be used by the class, each child having any three or four self-tones.
    On one tone trace around the border pattern made. On a second tone draw an oblong, a little wider and the same length as the design. A second oblong, a little wider than the first, may be drawn on a third tone of paper.
19. Cut and keep the forms traced.
20. Arrange and paste the design cut.

SIXTH YEAR.

1. An illustrated exercise to be given by the teacher (see page 48) in handling pigments for flat washes. How tints and shades are formed.

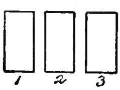


2., 3. Draw on the block five oblongs, by tracing around the narrow tablet. On space 1 place a wash of lighter red, on space 2 a wash of light red, on space 3 a wash of normal red, on space 4 a wash of dark red, and on space 5 a wash of darker red. Use colored papers as samples. Two lesson periods.

4., 5. Draw on the block five oblongs, by tracing around the narrow tablet. On space 1 place a wash of lighter yellow, on space 2 a wash of light yellow, on space 3 a wash of normal yellow, on space 4 a wash of dark yellow, and on space 5 a wash of darker yellow. Two lesson periods.

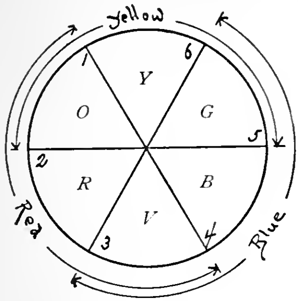
6., 7. Draw five oblongs on the block, as in the lessons previously described. Make a color scale of blue. Two lesson periods.

8., 9. Draw three oblongs on the block, by tracing around the wide oblong tablet. On the left oblong place a wash of red, grading from the lightest tint at the top to the darkest shade at the bottom. On the middle oblong place a graded wash of yellow, and in the right oblong a graded wash of blue. See page 50. Two lesson periods.



10., 11. Draw with the compasses a 5″ circle whose centre is in the middle of the block. Draw a horizontal diameter. Divide the circumference of the circle into six equal parts by setting off the radius of the circle above and below the ends of the diameter drawn. Draw diameters through these points. Prepare the paper as explained, and place over the upper half of the circle, extending from 2 to 5,

a flat wash of normal yellow. After this has thoroughly dried place a wash of normal red over the left half of the circle, beginning at



1 and extending to 4. When this is dry place a flat wash of normal blue over the right side, beginning at 6 and extending to 3. While the washes are drying a general review of color work may be given. After all the washes are completed, children name the colors formed by the overlapping washes. Two lesson periods.

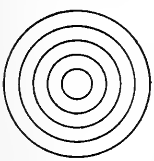
12. FOLDING AND CUTTING. Trace around a $2\frac{1}{2}''$ circular tablet on practice paper and cut. Fold for four, five, or six points, as desired, and draw and cut a variation. Unfold and use as a pattern for unit of surface decoration, or to repeat for a border design. Also cut a background pattern for this unit. If preferred, a bi-symmetric unit may be cut.

13. All the tones of the six leading and six intermediate colored papers are to be used for this design, each child having any three or four self-tones. Trace the patterns as many times as units are required.

14. Cut the units traced.

15. Paste the design for surface decoration.

16. Draw five concentric circles on the block of 6, 5, 4, 3, and 2 inches in



diameter. Place a cardboard under the centre, to avoid making a large hole. These circles are to be covered with flat washes, giving five tones of any one of the primary colors. Part of the pupils use red, part yellow, and the rest blue. It will be found easier to handle the washes by making the outer circles the lightest. This wash may be placed over the whole circle, the next wash over the whole of the next smaller circle, and so on to the centre, which is the darkest shade. Each wash must be thoroughly dry before the next is put on.

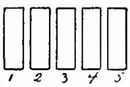
17. Complete the chart of graded circles.

18. }
19. } Select an example of historic ornament studied this year, and make an original arrangement of the units selected. Draw the enclosing form and construction lines on practice paper. If the design repeats one unit, after drawing half the unit fold on its axis and cut, thus obtaining a pattern. Draw very lightly on the block the border lines of enclosing form. Trace around the pattern made. This avoids erasing, which will prevent the laying of flat washes.

20.
21. This design is to be executed in any three self-tones of the primary
22. colored pigments. Moisten the paper with a damp sponge or cloth. Prepare a wash of the lightest tone of the color to be used, and cover the entire surface of the design, working as in the lesson upon the circular color scale. Each wash must be dry before another is put on. See page 50.

SEVENTH YEAR.

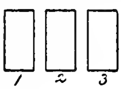
1.
2. Draw on the block five oblongs, by tracing around the narrow oblong tablet. On space 1 place a wash of lighter orange; on space 2, a wash of light orange; on space 3, a wash of normal orange; on space 4, a wash of dark orange; and on space 5, a wash of darker orange. Use colored papers as samples. Two lesson periods.



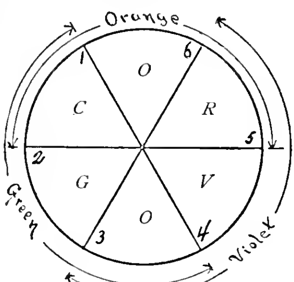
3.
4. Draw five narrow oblongs on the block, as explained in Lesson 1. Make a color scale of green. Two lesson periods.

5.
6. Draw five narrow oblongs on the block, as explained in Lesson 1. Make a color scale of violet. Two lesson periods.

7.
8. Draw three oblongs on the block, by tracing around the wide oblong tablet. On the left oblong place a wash of orange, grading from the lightest tint at the top to the darkest shade at the bottom. On the middle oblong place a graded wash of green, and on the right oblong place a graded wash of violet. Two lesson periods. See page 50.



9.
10. Draw with the compasses a 5″ circle, whose centre is in the centre of the block. Draw a horizontal diameter. Divide the circumference of the circle into six equal parts by setting off the radius of the circle above and below the ends of the diameter drawn. Draw diameters through these points. Prepare the paper as explained, and over the upper half of the circle, extending from 2 to 5, place a wash of normal orange. After this has thoroughly dried, place a wash of normal green over the left half of the circle, beginning at 1 and extending to 4. When this is dry, place a flat wash of normal violet over the right half, beginning at 6 and extending to 3. While the washes are drying a general review of the color work may be



given. After all the washes are completed have children name the colors formed by the overlapping washes. Two lesson periods.

11., 12. Previous to these lessons a border design, using historic ornament as detail, has been made. These two periods are devoted to transferring this design to the water color block.

13., 14., 15. This border design is to be executed in self-tones of the secondary colors obtained by mixing the primary colors. Part of the class work with orange, part with green, and the rest with violet pigments. When nearly dry, place the lightest tone to be used over the whole design. Continue as previously explained until the design is completed. See page 50.

16., 17. Pupils bring simple flowers from which to get suggestions for rosettes, to be used as units for surface or border designs. Two lesson periods may be devoted to cutting patterns of units and backgrounds, preparatory to constructing the design of colored papers. It is desirable to have as great a variety as possible in the forms used by the different pupils.

If desired, pupils may cut patterns for bisymmetric arrangements. Very pleasing results are obtained in a variety of ways by the use of colored papers in design.

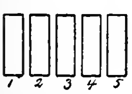
18., 19., 20. This design is to be executed in colored papers. Colors which form complementary harmonies, or which combine the tones of the grays with those of the six leading colors, may be used; or pupils may be allowed, with occasional suggestions from the teacher, to select their own combinations of colors.

These lesson periods are to be devoted to the tracing, cutting, arranging, and pasting the units of this design.

EIGHTH YEAR.

1. General review of all the colors studied.

2., 3. Draw on the block five oblongs by tracing around the narrow oblong tablets. On oblong 1 place a wash of lighter citrine; on oblong 2 place a wash of light citrine; on oblong 3, a wash of normal citrine; on oblong 4, a wash of dark citrine, and on oblong 5, a wash of darker citrine. Use colored papers as samples. Two lesson periods.



4.–5. Draw five oblongs on the block, as explained in Lesson 2. Make a color scale of olive. Two lesson periods.

6.–7. Draw five oblongs on the block, as explained in Lesson 2. Make a color scale of russet. Two lesson periods.

8.–9. Draw three oblongs on the block by tracing around the wide oblong tablet. (See Seventh Year, 7th Lesson.) On the left oblong place a wash of citrine, grading from the lightest tint at the top to the darkest shade at the bottom.

On the middle oblong place a graded wash of olive, and on the right oblong a graded wash of russet. Two lesson periods.

10. Exercise illustrating the effects of transmitted light (see page 50).

11. Have children try to match, with colored papers, the colors produced by transmitted light.

12. Children try to match, with washes or colored papers, the colors produced by transmitted light.

13. Children try to produce apparent colors as seen in some simple study from still life. (Optional.)

14.–15. An elementary bisymmetric or balanced design has been previously made (see Manual, thirty-first week), and these two lesson periods are devoted to transferring the design to the water-color block.

16.–18. This design is to be executed in washes of self-tones of the tertiary colors. Three lesson periods devoted to coloring the design.

19.–20. Good designs in wall-paper friezes have been previously brought by the pupils to the teacher for approval. These two lesson periods are devoted to transferring the designs to the water-color blocks.

21.–23. Three lesson periods devoted to copying the wall-paper frieze in water colors.

DEFINITIONS.

Absolute color. — See local color.

Advancing and receding colors. — Those colors have been called advancing and receding whose tendency is toward yellow or blue respectively; but the yellow sunset sky is behind the blue hills, and it is difficult to classify colors in this way, as a yellow or any other color advances or retreats according to its relations with other colors.

Apparent color. — The color which any object appears to have.

Brightness or luminosity. — The strength of the light sent to the eye by any color. A luminous or bright color sends a large amount of light to the eye.

Broken color. — Color changed by the addition of gray.

Cold colors. — Those in which blue predominates.

Color. — The result of the decomposition of light into the various elements composing it. It is a sensation due to the effects produced upon the eye by the waves of different lengths found in light, and does not exist outside of ourselves. Practically we speak of material color as that which decomposes light, and most objects are colored in the sense that they decompose light and send to the eye rays which are not white. Thus a body which reflects all the rays equally is white ; one which absorbs all the rays except the red rays is red ; and one which absorbs all the rays except the blue is blue ; and one which absorbs practically all the rays is black.

Complementary colors. — See pages 22 and 24.

Contrast. — The effect due to the juxtaposition of colors of a different nature or hue, or of different tones of the same color.

Harmony. — Harmony in color is the pleasing effect due to the action upon each other of colors which are improved and made more beautiful by their juxtaposition.

Hue. — Hue has about the same meaning as color. It will be used in these notes to designate the change in a color caused by the addition of a small amount of another color.

Intense or saturated. — Colors are intense or saturated when they are both pure and luminous to the greatest extent. The colors of the spectrum are intense or saturated.

Light. — The agent which produces vision. Light is supposed to travel in straight lines by means of minute undulations or waves in the particles of ether which fill all space. A ray of solar light is composed of a large number of differently colored rays of light, which uniting form white light. These differently colored waves are found to have different wave lengths. When the waves are about $\frac{1}{39000}$ of an inch long they produce the sensation called red; and as the waves become shorter, the color sensations pass from red to yellow, green, blue, and violet. The colors of the spectrum are immaterial color.

Local colors. — The actual color of the light which is not absorbed by any object. This color is visible when the object is near the eye and does not reflect colored light received from any other object. To show the local color, the rays must reach the eye unchanged by atmosphere or by reflected or transmitted lights from other objects. This can rarely happen, and the color which an object appears to have is seldom its local color.

Neutral colors. — Colors not pure or decided, such as the grays.

Opaque colors. — Those which do not allow the paper or canvas to be seen through the color. By mixing with opaque color, such as Chinese white, the transparent colors become opaque.

Pigment colors. — All colors used in the industrial and fine arts.

- PRIMARY PIGMENT COLORS. — Red, yellow, and blue. For the light primaries see Chapter III.
- SECONDARY PIGMENT COLORS. — Those formed by the mixture of the pigment primaries. They are orange, from red and yellow; green, from blue and yellow; and violet, from red and blue.
- TERTIARY PIGMENT COLORS. — Those formed by the mixture of the pigment secondaries. They are russet or red gray, formed by mixing orange and violet; citrine or yellow gray, formed by mixing orange and green; olive or blue gray, formed by mixing green and violet.

Positive color. — Pure and decided color.

Pure or normal colors. — Pure colors reflect to the eye color unmixed with white light. The solar spectrum contains the colors generally accepted as the pure, or normal, colors. With pigments it is possible only to approximate the pure color, as all reflect white light. Used by artists, the word means that the color of a picture is rich and clear, not muddy or dirty.

Reflected light. — The light generally seen on the shadow side of any object, caused by light reflected from another part of it or from some other object.

Scale. — Scale designates the arrangement of a color with its various tints and shades in regular order, from the lightest to the darkest. The

word also means the gradations of color by which one color changes into another, as in the spectrum the color passes from red to orange, yellow, green, and blue by gradual changes of hue.

Shade. — A tone of a color produced by the addition of black pigment to material colors, and by the action of a feeble light upon immaterial colors.

Shadow. — Shade and shadow have about the same meaning, as generally used; but for the sake of clearness it will be well to designate by shadow those parts of an object which do not receive any direct rays of light, while those surfaces whic' receive little direct light, and are thus intermediate in value between e light and the shadow, are called shade surfaces.

The term "cast shadow" may then denote the shadow projected on any body or surface by some other body.

Solar spectrum. — The result of the decomposition of sunlight into all the colors which form it. It may be obtained by holding a triangular prism of glass in the rays of sunlight, so that the refracted rays may fall upon a sheet of white paper. The principal solar spectrum colors are red, orange, yellow, green, blue, and violet.

Tint. — A tone of a color produced by the addition of white to oil colors, water to water colors, and of white light to the immaterial colors of the spectrum.

Tone. — Tone designates the changes which color undergoes by the addition of white, which lightens, or of black, which darkens its normal tone. The word also means the effect of some predominating color produced by the color of the light which illuminates the object.

SELF TONES. — Tones of the same color.

Transparent colors. — Those in which the color tints the paper or canvas, which shows through the color, and acts with it in producing the effect.

Value. — The relative amount of light contained in different colors. The strongest value is the lightest.

As used by artists, the word generally means the difference in effect due to any cause whatever; as light, shade, color, atmosphere, etc.

Warm colors. — Those in which red and yellow predominate.

ADVERTISEMENTS

HOW TO EXPLAIN THE REMARKABLE SUCCESS OF BLAISDELL'S PHYSIOLOGIES.

1. The matter of the books is fresh and to a considerable extent new.

2. Unlike most text-books on the subject these are interesting. The author has gained popular success as a writer on other topics, and has a command of style.

3. The language is clear, terse and suggestive. Consequently the ideas strike home at once and stay in the memory.

4. The author, a successful practicing physician as well as an experienced educator, has handled the subject scientifically though not technically.

5. Special emphasis is everywhere laid upon what is of prime importance — personal care of the health. The author gives countless practical suggestions growing out of his medical experience that cannot fail to be of life-benefit to the pupils.

THE whole story in a nutshell about the Blaisdell's Physiologies. They are true, scientific, interesting, teachable.

Accurate and teachable.

Blaisdell's Physiologies are among the very best text-books which the country has produced. They are accurate and teachable. Their author is a scholar, a physician and a teacher. — W. A. MOWRY, *recently Supt. of Schools, Salem, Mass.*

Clear, pointed and concise.

I have examined Blaisdell's How to Keep Well, and am very much pleased with it. Everything is clear, pointed and concise, as well as interesting. It covers all of the necessary points, and gives all necessary information. — F. A. MORSE, *Master Sherwin School, Boston, Mass.*

One of the sensible, practical books.

Our Bodies and How We Live is one of the sensible, practical books which Dr. Blaisdell is accustomed to write, and which I think must be useful for its purpose. The amount of good advice wrought into the text is in accordance with the intent of the recent effort to promote moral instruction in our schools, and I think it is judiciously done. — C. F. P. BANCROFT, *Prin. Phillips Academy, Andover, Mass.*

Attractive, practical and teachable.

I find Blaisdell's Physiologies attractive, practical and teachable, and well worthy of the high claim that is made for them. — MARK PITMAN, *Prin. Woolsey School, New Haven, Conn.*

The whole series intensely practical.

In my judgment, Blaisdell's Physiologies, which I used for three years, are among the best of the many excellent text-books upon the important subject of which they treat. The style is right, neither too technical nor too diffuse; the experiments are wonderfully ingenious and interesting; the whole series is intensely practical. I always recommend them to the members of my training classes as text-books which can hardly fail to excite interest. — C. T. R. SMITH, *Prin., Lansingburg Academy, N. Y.*

6. The author knew how to make a *text-book*. As a prominent superintendent says, "He was naturally gifted with the schoolmaster faculty."

7. All the important facts of each chapter are illustrated by a systematic series of simple experiments which the pupil can perform with little or no outlay for apparatus. This feature is peculiar to the Blaisdell books and has been found no less valuable than original.

WOULD you like to know how important facts in physiology can be illustrated by a series of simple experiments? Use the Blaisdell Physiologies.

The practical advice of great value.

The revised edition of Blaisdell's Our Bodies and How We Live seems to me to express in a remarkably clear and systematic way the most important facts in Physiology, while the practical advice it gives as to the care of the health ought to be of great value to the student. — HELEN F. PLAISTED. *Teacher of Physiology, Coburn Classical Institute, Waterville, Me.*

Plain, common-sense, practical.

Blaisdell's Physiologies seem to be just what they purport to be — a plain, common-sense, practical presentation of the subject. I believe them to be very well adapted for use in the public schools. — A. H. CAMPBELL, *Prin. State Normal School, Johnson, Vt.*

No series more attractive.

I know of no series more attractive in form and admirable in arrangement and character of material. The plan of test questions is good, and the chapters on Every Day Health and Practical Experiments are excellent.— E. N. BROWN, *Supt., Hastings, Neb.*

DIAGRAM OF THE ARTERIAL SYSTEM.

8. The author, recognizing the practical importance of *physical exercise* to young people, has incorporated into the series the latest and best ideas on the subject of physical culture.

9. Special reference is made *throughout the book* to the evil effects of stimulants and narcotics on the human system. These effects are set clearly and forcibly before the pupils' minds as the different topics are treated, and not in a mass at the end of the volume.

10. In brief, each book presents, as good taste and good sense dictate, a well graded statement of the things which all children of that age should know.

11. The author combines qualifications seldom found together, — the natural teacher, the practiced writer, the successful physician, and the man of science.

THERE is a good way to test Blaisdell's Physiologies for yourself: read them. There is a better way: try them in your schools.

Recognizes its merits.

I have examined with care Blaisdell's "Our Bodies" and am much pleased with it. Its merits to my mind are: 1. Clear and simple statements of fact, such as any child of ordinary intelligence can comprehend; 2. The use of the experimental method by which he makes his readers avail themselves of easy, simple but convincing experiments, one of which is worth a dozen merely dogmatic statements of the same facts. — W. W. KEEN, *the eminent surgeon and medical writer, Philadelphia.*

Remember that Blaisdell's Physiologies are published by Ginn & Co.

A HYGIENIC PHYSIOLOGY. For the Use of Schools. By D. F. LINCOLN, M.D. 12mo. Cloth. Illustrated. 206 pages. For introduction, 80 cents.

The chief object of this book is to present the laws of health as fully as pupils fourteen or fifteen years old can understand, appreciate, and apply them. Its distinctive feature is thus to put Hygiene first and making Anatomy and Physiology tributary, instead of making them the main things and introducing Hygiene incidentally. Enough of the theoretical is given to supply a basis for the practical, but it is given with a varying fullness according to the nature of the topic under consideration. Alcoholic beverages have a chapter to themselves, and additional matter is given at the end of the chapters on other subjects. It has been one of the writer's special endeavors to present this matter wisely and truthfully.

THIS is the first school text-book of Physiology to recognize the difference between means and end, and to proceed accordingly.

The best beyond comparison.

It is most admirably adapted to its purpose,— clear, concise, accurate, exceedingly well arranged for the teacher and interesting to the pupil. I do not know any other book to compare with it. — CHARLES F. FOLSOM, M.D., *Boston, Mass.*

The thing for the pupils.

With its excellent choice of material, clear statements, and admirable diagrams, I should like to see a copy in the hands of every pupil. — HELEN A. GARDNER, *Assistant in Girls' High School, Boston, Mass.*

A fascinating book.

It is so fascinating that I consumed almost a whole evening when I needed the time for other work. — M. P. LACKLAND, *formerly Pres. Chaddock College, Quincy, Ill.*

The best.

The hygienic part is the best I have ever seen in quantity and quality and exceedingly well put. The illustrations are remarkably clear and attractive. . . . It is the best work I know for my purpose, and we shall try it. — L. J. TUCK, *Teacher in High School, Pawtucket, R.I.*

SCHOOL HYGIENE. Six Lectures delivered under the auspices of the Mass. Emergency and Hygiene Association by prominent physicians of Boston. 12mo. Cloth. 196 pages. Mailing price, 88 cents; for introduction, 80 cents.

1. **School Hygiene,** by FRANK WELLS, M.D. 2. **Heating and Ventilation,** by F. W. DRAPER, M.D. 3. **The Use and Care of the Eyes, especially during School Years,** by C. H. WILLIAMS, M.D. 4. **Epidemics and Disinfection,** by G. B. SHATTUCK, M.D. 5. **Drainage,** by FRANK WELLS, M.D. 6. **The Relation of our Public Schools to the Disorders of the Nervous System,** by CHARLES F. FOLSOM, M.D.

Every thoughtful teacher will be more serviceable to his school for having read it. — R. G. HULING, *Prin. of High School, Cambridge, Mass.*

Each lecture is from the pen of one exceptionally competent to deal with his subject. — THE ADVERTISER, *Boston, Mass.*

NEWELL'S BOOKS ON BOTANY.

OUTLINES OF LESSONS IN BOTANY. For the use of teachers, or mothers studying with their children. By JANE H. NEWELL.
Part I.: From Seed to Leaf. Square 12mo. Cloth. 150 pages. Illustrated. For introduction, 50 cents.
Part II.: Flower and Fruit. 393 pages. Illustrated. Cloth. For introduction, 80 cents.

These Outlines are intended to guide the pupil's inquiries. The beginning of the study of any branch of Natural Science by the young should be the observation of the most obvious things about them, the things they can see and handle and experiment upon naturally, without artificial aids.

A READER IN BOTANY. Selected and adapted from well-known authors. By JANE H. NEWELL.
Part I.: From Seed to Leaf. 12mo. Cloth. 199 pages. For introduction, 60 cents.

The purpose of this book is to supply a course of reading calculated to awaken the interest of the pupil in the study of the life and habits of plants. Four of the articles have been written especially for this Reader.

A READER IN BOTANY. Selected and adapted from well-known authors. By JANE H. NEWELL.
Part II.: Flower and Fruit. 12mo. Cloth. 179 pages. For introduction, 60 cents.

This volume follows the first part in supplying a course of reading in Botany for pupils of the higher grades. It deals with the life-habits of plants, especially as relating to the flower and fruit.
The articles are chosen from well-known writers and will be found stimulating and suggestive of lines of original observation.

HARDLY any subject can be made more interesting to children than Botany, presented according to the method of this charming author.

Logical and Scientific.

I have read Miss Newell's book with very great interest. It is logical in plan, scientific in treatment, and without doubt will be found most convenient in practice. I can commend it to all beginners. — W. F. GANONG, *Instructor in Botany in Harvard University.*

It follows the best method.

It is a charming little book, written by one who is evidently familiar with the best methods of instruction. It should be in the hands of every teacher giving plant lessons. — W. H. LENNON, *State Normal School, Brockport, N. Y.*

LITTLE FLOWER-PEOPLE. By GERTRUDE ELISABETH HALE. Sq. 12mo. Illustrated. Cloth. 85 pages. Price for introduction, 40 cents.

The aim of this book is to tell some of the most important elementary facts of plant-life in such a way as to appeal to the child's imagination and curiosity, and to awaken an observant interest in the facts themselves.

Interesting and delightful.

I find the little book both interesting and delightful. I have recommended it to the teachers of our lower departments in the hope that their pupils may find in its pages an incentive to the study of flowers. — MARY A. WILLIS, *Packer Collegiate Institute, Brooklyn, N.Y.*

Helpful in model school work.

The book pleases me and I shall recommend it to my classes in botany. I am sure it will be very suggestive and helpful in our model school work. — CHRISTOPHER NOSS, *formerly Teacher of Botany, Keystone State Normal School, Kutztown, Penn.*

GLIMPSES AT THE PLANT WORLD. By FANNY D. BERGEN. Fully illustrated. 12mo. Cloth. 156 pages. For introduction, 50 cents.

The question how the children can be easily taught something of natural science finds an answer in books like this, attractively written and correctly and copiously illustrated. In other countries one finds many pretty and cheap little books so written as to convey impressions in harmony with science; yet using language familiar and adapted to the child-mind. This is a capital child's book, for it covers quite an area of botanical study and presents a good array of interesting facts relative to plant life.

It is a good supplementary reader for lower grades and an excellent collateral book for any student at work along botanical lines.

"INTERESTING as a story book." So say hundreds of teachers and pupils who have read and re-read Mrs. Bergen's delightful little book.

A delightful book in botany for any boy or girl.

This is a little book of only 156 pages, but it is packed full of nice and interesting things touching plants, geographically, naturalistically and botanically considered, that should draw, as magnets draw, every boy and girl who can get there to the woods, to the meadows, to the sea-shore. The young person who has not lived out-doors among plants and animals till by sight, at least, they are as familiar as men, women and children on the streets, is unfortunate. It is a delightful book in elementary botany for any boy or girl. — CHRISTIAN WEEKLY.

Remember that Ginn & Co. publish excellent botanies for supplementary use.

The Beginner's American History.

BY D. H. MONTGOMERY,

Author of "The Leading Facts of History" Series.

12mo. Cloth. 234 pages. With full Maps, Illustrations, Index, etc., and a List of Books of reference. For introduction, 60 cents.

COLUMBUS AS A BOY.

This book is, in many respects, a new departure. Its method is almost purely biographical; the history of the nation being presented in the stories of the lives of the founders and builders of America. These stories have been selected for their interest and value to children beginning the study of the history of our country, and so arranged that they fully cover, either directly or incidentally, all the main points in connection with the foundation and growth of the Republic.

The greatest care has been taken to relate only such incidents and anecdotes as are believed to rest on authorities beyond question. There will be nothing on these points to unlearn later.

The style is clear, simple, and direct. Any child who can read easy reading can understand it. The illustrations, like the text, are such as children will readily understand and enjoy.

ITS beauty, interest, and school-room availability. have already made it a success.

An admirable book.

An admirable book. . . . I am sure that the children agree with me. — H. P. WARREN, *Prin. of Albany (N.Y.) Academy.*

Admirable in design.

The book seems most admirable in design and in execution. The style is simple, the matter interesting, and the topics and illustrations are worthy of commendation. — J. R. BEVIS, *Supt. of Schools, Naperville, Ill.*

The best book for beginners.

It is the best arranged work for beginners I have ever examined. — C. F. FORD, *Prin. Doty Springs School, Newtonville, Miss.*

Does not know its equal.

What a book the Beginner's History is to awaken an interest in the subject! I do not know of its equal. — E. E. SMITH, *Prin. of Union School and Academy, Union, N.Y.*

The book comprises thirty biographies, all in the compass of two hundred and twenty pages, followed by a complete list of reference books for teachers and a very full index.

Besides the many maps and cuts scattered throughout the text, there are seven full-page illustrations and four full-page maps not included in the 234 pages of letter press.

CAPT. JOHN SMITH.

MORE space is given to the Telegraph, the Steamboat and the Railway, than to all the wars in our history.

Deserves wide circulation.

The book is an excellent one and deserves a wide circulation. — EDWARD BROOKS, *Supt. of Public Schools, Philadelphia, Penn.*

Will create a genuine love of history.

I believe the book will do much to create a genuine love of history in young pupils, and hence I have put it into the hands of the young women of the Normal School. — EDWIN A. ALDERMAN, *State Normal and Indus. School, Greensboro, N.C.*

It has no equal.

I am using it in my school. It has no equal for the grade for which it was designed. — GEO. H. LINSLEY, *Prin. School No. 1, Jersey City, N.J.*

Much pleased with it.

We have had it in use for two months past and are much pleased with it. — J. H. VAN SICKLE, *Supt. of Schools, Denver, Col.*

Most fascinating little book.

The most fascinating little book in this line. — C. C. BRAGDON, *Prin. of Lasell Seminary, Auburndale, Mass.*

An excellent book.

The Beginner's History is giving entire satisfaction. The pupils study it with pleasure, and by its use are acquiring a taste for historical reading. It is an excellent book. — CHAS. D. RAINE, *Prin. of Schools, Mt. Holly, N.J.*

Admirably adapted to awaken interest.

Admirably adapted to awaken interest in our country's history and prepare pupils for the formal study of it. — B. M. ZETTLER, *Supt. of Schools, Macon, Ga.*

An excellent work.

An excellent work, just what it purports to be. — J. H. PHILLIPS, *Supt. of Schools, Birmingham, Ala.*

A good teaching book.

It is excellent. It has the quality which makes his other books so valuable, — it is emphatically a good *teaching* book. Method, accuracy, neither too much nor too little said, the careful scholarship never allowed to become dull, — such are some of the excellences I find in the little book. — HELOISE E. HERSEY, *Prin. of Private School, Boston, Mass.*

Montgomery's Leading Facts of American History

is, as its name indicates, a bird's-eye view of the leading events of our history, with their causes and results clearly traced. The greatest merit of the work is in the judgment with which the "leading facts" have been selected and the vividness with which they are placed before the reader's mind. There is throughout a proper sense of proportion, too; and pupils who study this book will neither mistake mole-hills for mountains, nor be taught that great movements come without reasons and go without effects.

Montgomery's Leading Facts of American History

is full of thought and intellectual life. There are numberless incidental touches — of fact, thought, or feeling — that illuminate the narrative, and both stimulate and satisfy the reader's interest. Every one is urged to read a few pages and see for himself what this means. The learner's mind is kept awake and active. Acquisition is easy and permanent under such circumstances.

EVERY department of American life and activity receives attention, — industries, commerce, political and intellectual development.

Interesting and forcible in style.

It contains just what its title claims; and these facts are put in an interesting form, and clothed in language clear and forcible. I know of no book on American History from which the reader can gather so much valuable instruction in a brief time. — A. H. CAMPBELL, *Prin. of State Normal School, Johnson, Vt.*

Clear, fresh, and interesting.

The matter is well selected, and the style fresh and interesting. The first chapter on the discoveries deserves especial commendation for its clear explanations of the underlying causes of voyages of the period. — E. G. BOURNE, *Prof. in Adelbert College.*

Attractive, reliable and perspicuous.

We find it attractive in form, reliable and perspicuous in composition, judicious in choice of subject matter, and so full of a spirit of patriotism and Americanism that its use throughout the country must inevitably infuse new vigor into the life-blood of our glorious nation. — E. M. VAN PETTEN, *Supt. of Schools, Bloomington, Ill.*

A most excellent working book.

We have been using it for more than a year. I was pleased with the book at the start; teachers have liked it, pupils enjoy it, and I have had no reason to change my first opinion, that it is a most excellent working text-book. — FRED. GOWING, *State Supt. of Schools, N.H.*

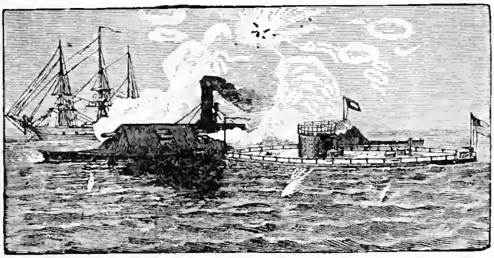
The more it is used, the better it is liked.

The more we use it, the better we like it. It is well arranged, the topics are treated clearly, and the subjects selected are those of the most importance in our country's history. It covers these admirably. For example, the administrations of the different Presidents are cases in point. I think this one of the many excellent features of this text-book. — LEWIS H. MEADER, *Prin. of Academy Avenue Grammar School, Providence, R.I.*

Montgomery's Leading Facts of American History

is as broad as the activities of American life have been various and full. It gives attention not only to the political, but to the industrial, commercial, and intellectual development of the American people. An enormous amount of investigation was required for this; but the author was interested himself, and his work does not smell of the lamp.

Montgomery's Leading Facts of American History



Fight between the "Monitor" and the "Merrimac."

is satisfactory to philosophical and to practical teachers. The proof was read by a college professor, two teachers of U.S. history, and one schoolboy. Abstruse terms and hard words were discarded for simple, concrete, and picturesque expressions.

THE author's sympathies are too broad to admit of partisanship, sectarianism, or sectionalism.

Every way admirable.

I have read it carefully and with great interest. It is in every way admirable. — P. V. N. MYERS, *Author of "General History," etc.*

A book that will teach.

It is as interesting as romance. It is instructive, especially upon matters pertaining to the customs of the people and to their methods of advancing their welfare. With these excellences, it must prove also a book that will teach. — GEORGE A. WALTON, *Agent of the Massachusetts State Board of Education.*

More than meets expectations.

We find the work clear, concise, and attractive. It is unquestionably the best school history with which I am acquainted. — E. G. MACHAN, *County Supt. of Schools, Lagrange County, Ind.*

Instinct with vitality.

The bones are all here, but they are clothed with the proper connective tissue, and the whole organism is instinct with vitality. . . . The style is noticeable for its clearness, conciseness, and color.—PUBLIC OPINION, *Washington.*

Impartial at all points.

The author — the first to perceive that the Irish had any share in the planting of the American colonies, and the first to refrain from that patronage of the Catholic Lord Baltimore, which is but a shade less offensive than deliberate insult — holds the scales very evenly between the North and the South, and does equal justice to the enterprise of the West and the conservatism of the East. — THE PILOT, *Boston.*

Shows the inner life of the people.

To learn history is not so much to remember dates of battles or of great events as to secure in the mind a clear idea of the inner thought and spirit of the people which has shaped the national life. In this the author has done exceptionally good work. — THE INTER-OCEAN, *Chicago.*